Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR. Editor

HAROLD V. BOZELL Editor

Volume 83 New York, Saturday, January 5, 1924 *Number* 1

The Greatest Young Industry

WITH its tentacles reaching to the furthermost corners of the earth and at the same time most intimately touching the every-day life of the humble citizen, commanding the attention of the ablest of executives and engineers, constantly in the limelight in the business and financial world, a factor of prime importance in any industrial or social advance, presenting a record of accomplishment and continued financial stability as convincing as it is startling, the industry portrayed in the pages of this issue—the greatest young industry the world has ever seen—should be fully proud of its remarkable record and yet thoroughly humble in attitude as it faces its heavy responsibilities. At the same time, there is shown how with confidence the industry may look ahead to a still greater future. Statistics presented in this issue make it possible for the first time to look ahead with accuracy to the expectations of the next ten years. Reflected there, the central-station business, the core of the industry, sees itself alone a twelve-billion-dollar industry—two-thirds as large as the total of the railroads today.

This future growth will not be attained without proportionate effort, but men of this industry must rejoice that fate has cast their lot where it did and that it has given them the opportunity of working in a young and virile industry whose every effort is directed toward the improvement of man's social and industrial welfare.

The Problems Which Face Central-Station Executives

THE continued growth of the electric light and power industry and its immediate requirements serve to draw attention to the burdens which fall to the lot of the executive. At first, as development followed development and the art was in the making, the problems of the industry were chiefly of an engineering nature. Gradually, however, as practices became standardized and a wider market for energy had to be created, economic and commercial considerations grew in importance so that for the last five years the business side of the industry has occupied the center of the stage. Electric service has become very popular. The revenue of central stations has quadrupled in ten years, and practice has shown that for every dollar of added revenue an investment of from four to six dollars must be made. To raise these huge sums for a regulated business with fixed earnings is no easy task. So far, however, the resourcefulness of executives has kept the problem within bounds. Customer ownership of securities, just to mention one activity, has worked wonders in making senior securities upon which the industry must depend for the greater part of its money more attractive; but financial problems increase each year.

Great strides toward conservation in the use of fuel and also in the development of water power have been made by the engineering departments. The public has reaped the benefits of this in rates for service. Interconnection has also played a very important part in keeping rate schedules at their present low level. The vagaries of the coal situation, however, have caused executives many sleepless nights during the last ten years and tied up large amounts of money in coal reserves. With the increasing amounts of coal required by the expansion of the electric light and power business the question of adequate and continuous coal supply becomes more and more serious.

Water-power development happily has gone forward at an amazing rate ever since the passage of the federal water-power act, and yet executives are confronted with state ownership schemes which tend to jeopardize the immense investments made in the interests of the public. Contrary to fact, water powers are still looked upon as gold mines by those who never invested a cent in them. Experience would have taught them otherwise. Fortunately, the industry has worked in such close harmony and to such telling advantage that rates for service throughout the country show a decrease rather than an increase. This has meant much in the shape of added good will and in the absence of strife over rate reductions, and executives have not been slow in capitalizing this advantage. Encouragement of this kind is welcome, but should be accompanied by some reward for accomplishment. However fascinating the work of providing electric service may be, the job is hardly worth while if all the savings made possible through the unremitting toil of engineer and executive are to be passed on to the public. The industry has rendered an excellent account of its stewardship. Executives are broad-minded enough to continue to render excellent service whether rewards follow quickly or not. The raising of billions of new capital, however, the operation and interconnection of systems, the development of water power, the keeping of rates stable in the face of rising costs—all call for skill and experience of a high order and should be commensurately rewarded.

Why Can We Not Have Dependable Production Statistics Now?

EACH year on the first of January it is borne in upon the electrical man with particular force that he is seriously hindered by the lack of statistics of production in the manufacturing and distributing branch of the electrical industry. Through the year the pressure of daily work tends to divert his mind from this well-known fact. But when the year is done and he pauses to appraise the last twelve months and to plan ahead, he faces squarely the unfortunate fact that he must base his estimate mainly on guess. Statistics such as are presented in this issue of the ELECTRICAL WORLD give him a record of progress in the central-station branch of the industry. But there statistical accuracy stops. Nobody knows with definiteness how

many motors, transformers, sockets, fuses or how many feet of wire have been produced in the United States, nor what the sales have been, nor what stocks there are in the warehouses of the industry. On all this, there are only the most approximate general figures.

It is not necessary to enumerate the advantages that would come from the possession of dependable statistics on production, sales and stocks of all electrical commodities. Knowledge gives strength to any man. And market estimates based on guesswork must needs be largely vitiated by inaccuracies and inefficiency. Why can we not have such statistics in the electrical industry now?

The matter has been under general discussion among electrical men for several years, and it has been the gossip of the industry that a large number of both the smaller and the larger manufacturing companies have signified their willingness, their desire to contribute their own figures—yet the matter stands, and other years roll by in which the industry is seriously handicapped by an inability to weigh and measure its achievements and its opportunities with a fundamental knowledge of facts.

There would seem to be no reason, save that of tradition, why the electrical industry should deny itself this valuable privilege. It never has been done—therefore some men fear lest these statistics should bring some dangerous advantage to their competitors. They forget that it is not the possession but rather the appreciation and the use of facts that gives power to knowledge. The publication of complete statistics of the electrical industry would not disturb the balance of strength and influence among electrical manufacturers, but it would increase the general proficiency and speed development all along the line.

The Progress of 1923—What Does It Mean?

ELECTRICAL men are naturally well pleased with the progress that has come in 1923. It has been distinctly a year of prosperity in the electrical industry. Homes have been wired in apparently phenomenal numbers. Industrial load has increased by leaps and bounds. Unprecedented sales of appliances have been made. There has been seen the greatest rate of increase of electrical energy generated and sold in the history of the central-station industry. And this has all been reflected in large manufacturing activities. It is a matter of serious moment, however, that the signs be not read wrong. The record of 1923 needs to be analyzed with extreme care, if a true evaluation is to be derived.

The crest of the wave of post-war development and building in this country came about a year ago. The electrical man has been riding that wave. Even allowing for all the creative effort that has been applied through commercial departments or otherwise, it must be recognized that fortunate circumstances have probably contributed very materially to the remarkable achievements of the past year. It must not be taken for granted, therefore, that achievements recorded in 1923 constitute the measure of the productive worth of present methods of business development in the electrical industry. It is important to every man that due credit be given to the power of the wave.

It is undoubtedly a handicap to the industry that it has never been compelled to struggle for a market. For the first twenty years of its existence an insatiable popular demand absorbed all the energy that could be generated. Until twenty years ago there was virtually no selling problem in the central-station business. And from that time to this there have been several eras of prosperity in which capacity has been oversold. In the lean years between these fat ones executives have sometimes bestirred themselves to study and to practice the selling art, but each time, before they had gone very far, good times would come again with overdemand. Gradually considerable advancement has been made in the organization of market development, but the industry still rides the wave, and it has not yet learned what it means to row against head winds.

Good times will continue. The wave will carry on. But the question is, should this industry be content to ride along and do less creative work than it would be impelled to do if it were not so favored of the gods? A man has only so long to live. If he sees a goal which it is easy to reach in five or ten years, why should he not put extra effort into the work, reach it in one year or less and gain so much the sooner the benefits resulting from attainment? In our hearts we know that, despite great accomplishments, there is still much to do in the task of electrifying America.

Twelve Months' News in the Electrical Industry

THE rapidity with which history is made by the electrical industry in America is perhaps nowhere better demonstrated than in the news columns of the ELECTRICAL WORLD. A retrospective glance through these columns for 1923 shows a continuous record of planning, starting to build, putting into operation or expanding one big generating plant after another in every part of the country. The estimate, derived from the printed news of twelve months, of six hundred million dollars expended in buildings, equipment and transmission systems stands as a conservative total.

"High spots" of the recorded happenings in the central-station field for 1923 were the many changes in the ownership or control of operating companies, the formation of numerous mergers among companies occupying contiguous territory, the beginning of 220,000-volt transmission, the constant extension of interconnection and of "superpower" systems, the starting of the first mercury turbine, the adoption by several large companies of pulverized fuel, the employment of "wired wireless" in central-station operation, the further spread of customer ownership, and the efforts to serve the rural as well as the urban population.

Water power continued to play a great part in the record. The reports of the Federal Power Commission's rulings were of constant interest. The failure of Arizona to ratify the Colorado River compact and the fight over Diamond Creek and Boulder Canyon held the center of the hydro-electric stage in the Mountain and Southwestern States. The changing phases of the battle over Muscle Shoals, which attracted the interest of the whole nation to the water powers of the South; the contrasting policies of New York, standing for a narrow construction of state rights, and of Pennsylvania, championing the statesmanlike view that hydro-electric development is national in its nature; the political happenings affecting water power in these and other states; the persistent though thus far ineffective agitation for political exploitation of hydro-electric resources, especially strong on the Pacific Coast; the welcome if belated protests from Maine against that

state's policy of non-exportation—these were all matters of prime interest in the hydro world. Accounts, too, arrived from Europe and other foreign fields of great developments under way or in contemplation.

The annual convention of the National Electric Light Association and the gatherings of the American Institute of Electrical Engineers were the source of much engineering and operating news, and so to a less extent were the doings as reported of more than a hundred lesser bodies or bodies less closely identified with the electrical industry. The modifications made in the National Electrical Code were of importance. Advance notices of the coming World Power Conference in London hinted at history yet to be made. The progress shown in radio, national and international, can rightly be termed epochal. Among the hundreds of court and commission findings recorded were decisions important as precedents or ultimate in their nature, several of these being handed down by the Supreme Court.

Nor would this résumé in outline be complete without a reference to the distinctions won or fresh laurels achieved in 1923 by individual men of the industry. The record of research, invention, business enterprise and administrative genius is an impressive one. In this connection it is fitting, too, again to pay tribute to those whose passing has left our fraternity the poorer —Schuyler S. Wheeler, Louis Bell, John A. Britton, Charles P. Steinmetz and others not a few who in different spheres of usefulness wrought for it with brilliance and with faithfulness.

Engineering Developments in Retrospect

TO THE wonderful accomplishment of other years the past year added a greater advance, bearing in its turn the promise of a wider-horizoned future, than has ever before resulted in the electrical art in the same period of time. Bigger, better and more diversified applications of electricity were augmented by new inventions and new visions of a character to make a radical change in previous conceptions and practices.

Pressure for greater economy and less waste in production, transportation and communication, combined with a popular fancy for everything electrical, have induced these changes and have acted to awaken engineers to their opportunities and obligations both as citizens and as specialists. More and more they are participating in national political activities and assuming executive responsibilities in industrial organizations without ceasing to carry forward technical work essential to commercial progress.

Size is a very popular measure of accomplishment, and the outstanding things in engineering equipment produced during the year are so astoundingly big that the imagination falters in attempting to grasp them or to anticipate what is to come in the immediate future. A 62,500-kva. steam turbo-generator for the Brooklyn Edison Company is equalled by a 70,000-hp. hydraulic unit for the Niagara Falls Power Company. An induction motor on a frequency converter for the United Electric Light & Power Company is rated at 47,800 hp. Out on the Pacific Coast 220,000-volt transmission lines are placed in operation by both the Southern California Edison Company and the Pacific Gas & Electric Company, and these lines employ 30,000-kva. synchronous condensers as control equipment and use oil breakers and transformers which have established records for size and voltage. And while Big Creek No. 3 has gone into service as the largest hydro-electric station west of the Mississippi River, the Philadelphia Electric Company plans the immediate construction of a 600,000-kva. steam station. Besides these things, 37,000-kva. auto-transformers, 1,500,000-kva. rupturing-capacity oil breakers, 2,000,000-volt lightning generators, 33,000-r.p.m. superchargers for airplanes, 180,000-hp. electric marine equipments and 17,100-kva. air-cooled transformers must be included in the list of developments which establish world records for size in their respective classes of equipment.

To the big things should be added the new things which invention and engineering and commercial acumen have placed at the service of industry and the public.

In radio a new filament has made possible the more economical operation of vacuum tubes rated at from 0.18 watt to 20 kw., and innumerable inventions and circuits have been recorded which have increased the quality and convenience of wireless for pleasure and for business. The Hartford Electric Light Company has installed a 2,000-kw. mercury turbine and boiler to ascertain the economic status of such equipment in energy production. In Boston a boiler operating with a steam pressure up to 1,200 pounds is being installed in a commercial station; and the bleeder cycle with all-electric auxiliaries has been accepted as best for large steam stations.

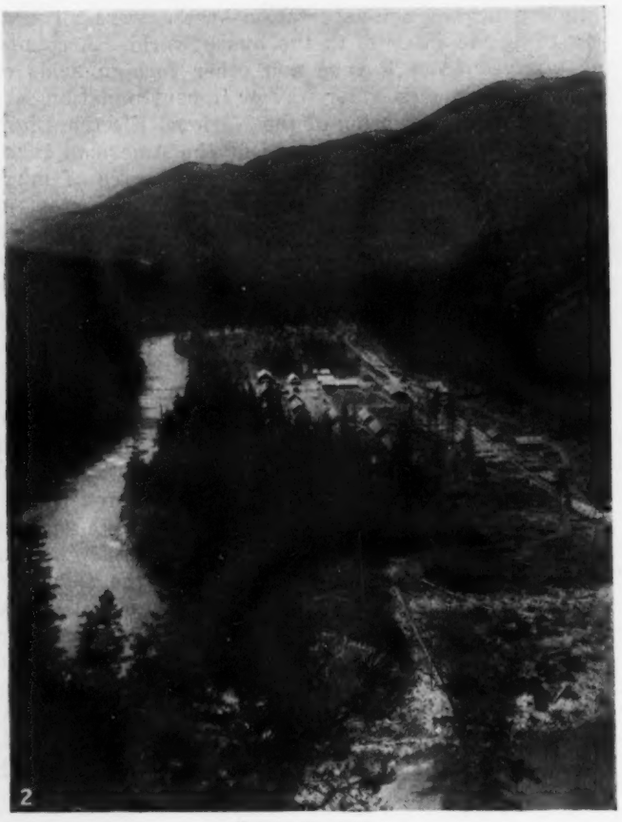
In the illumination field the tipless bulb and a better machine for making bulbs add new tools with which to continue the national educational campaign in the value and beauty obtained through adequate and artistic illumination. Better luminaires and standards have been developed to satisfy the nation-wide demand for street lighting that is at once an architectural and a practical asset to the community. The coiled-filament sign lamp has given a new and economical tool to those interested in advertising lighting. Higher intensity, always coupled with better diffusion, has proved a key to lowering production costs in industry.

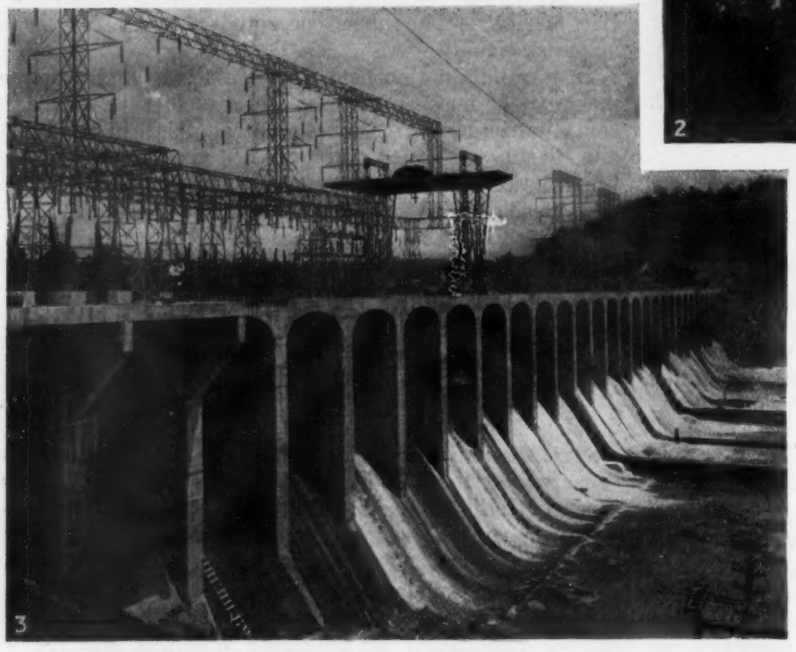
For industrial application, the manufacturers have developed new types of motors, new lines of motors, electric furnaces for many new purposes, static condensers and motors for power-factor correction, new types of lightning arresters, and very great improvements in control equipment for elevators, paper mills and other operations of various kinds.

The great popularity of automatic generating stations, substations and equipment has been aided greatly by the application of telephone practices and radio principles to remote control, automatic switching, communication between different points on the system and supervision of actual conditions existing simultaneously at important plant locations. In the telephone field machine switching has continued to advance toward a degree of perfection which indicates the early death of manual switching. Carrier currents, newer and better land and ocean cables, new types of printing-telegraph apparatus and the introduction of the telautograph on a commercial scale bring a vision of the day when sight as well as sound will be rendered available at will, independent of distance.

The golden day of engineering is here, when synchronized invention exists, when scientific skill reaps a commensurate reward, when the forces of nature have been subjected to the coercion of industry so that humanity may live better because more intelligently and more comfortably. The future, though formidable in its problems, is glowing in the promise of still greater services that shall be rendered by engineers.

Hydro-Electric Developments Are Having a World-Wide Boom





No. 1. The Alps are affording power to Europe. The illustration shows the storage reservoir at Pfaffensprung for the St. Gotthard development.

No. 2. Scene of Skagit River development on the Pacific Coast.

No. 3. A good view of Mitchell Dam—one of the major Southern developments.

No. 4. Shawinigan Falls development in Canada.

No. 5. Muscle Shoals is the subject of controversies.

Electrical Industry Should Be Optimistic Over Utility's Progress

New Records Established Each Year
Great Savings Effected Through Operating Economies
Electricity Steadily Decreasing in Cost

By Walter H. Johnson
President of the National Electric Light Association

Walter H. Johnson

BASED entirely on the record established in 1923, the electric light and power industry during the coming year should add appreciably to its laurels and its achievements. Certainly the new year holds every promise for greater activity and increased prosperity throughout the country, which must leave its impression on the utilities. Last year was not a normal year. The output of manufacturing and agricultural industries fell short of expectations, with the result that a clamor was set up for lesser burdens in the shape of lower taxes and freight rates. And yet in the face of this showing the electric public utilities added to their outputs and earnings, besides raising almost a billion dollars from the sale of bonds and stocks for the purpose of enlarging facilities and for refunding maturing obligations. This in itself is an accomplishment of which the industry may well feel proud, but the story is only partly told. We have grown in efficiency also, conserving fuel, labor and capital to such an extent that savings totaling many millions have been passed on to the public. If, therefore, to the normal growth be added the increase which must follow the greater prosperity of manufacturers and farmers, 1924 will establish a high record in the electric light and power industry.

Just how great a saving the industry has been able to effect by interconnection and other operating economies is not readily appreciated. The cost of coal and its transportation is still much higher than it was in 1913; so is the cost of labor and of equipment. Food, clothing, housing, furniture, etc., show a uniform increase over the 1913 average ranging from 49.3 per cent in the case of food to 122.4 per cent in the case of furniture. Yet electricity, to use the official figures of the Department of Labor, has steadily decreased in cost from 2.6 per cent in December, 1918, to 5.1 per cent in September, 1923, and is the only item included in the Labor Department's cost-of-living curve to show a decrease over the figures for June, 1923.

Now, all of this has been brought about through the installation of larger and more efficient generating apparatus, greater use of existing investment by means of interconnection and interchange of energy, elimination of losses and greater service on the part of the operating staffs. But there are still great possibilities in store and, given some encouragement and fewer legal restrictions, it ought to be possible for the industry to keep up the good work and enhance the record.

Greater standardization, for example, should lead to certain economies in operation through wider interconnection of generating systems without the interposition of transforming apparatus. Simplification also is not without its advantages, particularly in rate schedules. Fortunately, simplification and standardization have come with experience and practice, but neither has reached perfection. Improvements are constantly being made in steam and electrical apparatus. Hydroelectric stations are now very efficient and the art of electric transmission of energy has been greatly perfected. Our problem is not to generate electricity cheaply—we do that now. We must look beyond the generating station for greater economy and yet not overlook the possibility of still greater efficiency in the generating station itself.

This means that we must make a greater use of the investment already made in lines, meters, transformers, etc., and thereby decrease the investment per customer. We must guard against greater tax burdens and if possible reduce those we now bear. Our earnings should be such and our dividend record so continuous that we shall be able to command the necessary capital for the conduct and enlargement of the business at a lower rate. It is not always appreciated that the tax collector makes more on our properties than the men who have placed their money in the business, and that a reduction in interest rate of 1 per cent over the life of long-time bonds has a greater effect on rates at times than the economies made by the engineering staff. Of course, these things are easier said than done. I mention them merely to show the direction along which greater economies are to be looked for.

In the matter of public relations we have but to continue on the present path. By giving our customers the very best service at the lowest possible cost, treating them courteously, and inviting them to become partners in the business, we shall build up a good will, and deservedly so, which will serve as a bulwark against oppression and the assaults of the politician and the demagogue. Our record already commands the respect of all thinking men, and if we have not received the wider public recognition that is our due, we may console ourselves with the knowledge that we are on the right path, that we are doing our work well and that in time appreciation will come. The knowledge of what to do is with us, and by and large the will to do it also. It remains for us but to carry on.

Samuel Insull

Comments on Past and Present

Problems and Opportunities of Utilities

Must keep ahead of industrial progress

Fair dealing establishes good public relations

Thoughts on rural service, diversity factor and interconnection

RECOGNIZING that a large part of the electric utility industry looks to Samuel Insull for inspiration and counsel, the editors of ELECTRICAL WORLD feel that they would be remiss in fulfilling their obligations to their readers if this Annual Progress and Review Number, which tries for the first time to make constructive and specific prediction into the next ten-year period, failed to contain an interview with Mr. Insull embodying his opinions on some of the problems and opportunities which face the industry. The interview, however, was not obtained easily, for, coupled with the well-known fact that Mr. Insull's varied interests make severe demands upon his time, he particularly shuns publicity. But finally convinced that it was his obligation to give the benefit of opinions acquired from his vantage point, he submitted, saying, "Well, what do you want me to say?" The representative of the ELECTRICAL WORLD to whom he addressed this query replied: "As a starter, Mr. Insull, what do you consider are the financial prospects of the utility business, and how can the status be maintained or improved?"

"Public utility companies," he replied, "by virtue of the character of their business—which is the business of supplying services that are essential to modern community life—must necessarily keep ahead of industrial progress. They must anticipate demands that will be made upon them as other lines of business expand. They must be ready to care for this expansion when it comes.

"America is, and has been since the war, the only great nation enjoying any degree of prosperity. This national prosperity is, I believe, in the ascendant. Therefore, I have no hesitancy in saying that the financial prospects of public utilities, and especially of electric light and power companies, never were better than they are right now. This does not mean, however, that there is no room for improvement in the electrical as well as the other branches of the public utility industry.

"The firmness of the electric light and power business may be gaged in no small measure by a review of its history during the last decade. To my knowledge, not a single company producing electricity that was on its legs in 1914 had to go into or through a receivership during the harassing world war period. In some instances during that period owners of junior securities suffered loss of dividends for a time, but in no instance within my knowledge did any electric utility of any size default its bond interest.

"I am convinced that the financial prospects of the electric companies of the nation have been improved to a marked extent through customer ownership of dividend-paying junior securities, and that customer ownership, more particularly as it relates to persons of small means, has not only given greater stability to outstanding junior securities but has added strength to outstanding senior securities."

At this point the representative of the ELECTRICAL WORLD interjected: "From your last remark, Mr. Insull, I would infer your view to be that the public attitude toward utilities is and will be a vital factor in their financial standing. What do you consider the essentials in securing public good will?

EDUCATION OF THE PUBLIC

"Education," he replied immediately. "On account of the unparalleled speed with which the various forms of public utility service have grown in this country, and on account of certain consequences of that rapid growth, the public never learned much until very recently about all there was back of the service itself.

"The electric, telephone and electric railway business, and the gas business in its now most important phase—that of a fuel business—are only about forty years old. Almost overnight, as it were, they rose from the experimental stage—in which they verged on the uncanny or impossible in the things predicted for them—to the position where today the four, considered as an industry, represent a total investment many times that of the other national industries, except agriculture and the railroads. Such expansion in itself would tend to engender suspicion. Add to this the fact that the arts of producing electricity and gas are almost like wizardry to the uninitiated, and you have another source of suspicion.

"Then, the public had no 'call' to inform itself. For one reason or another the utility companies had no 'call' to do the informing. Often they were so busy in taking care of demands for their service—building and extending and improving their service facilities—that they never thought of the necessity or desirability of telling the world about themselves. Consequently the 'informing' was mostly left to persons who had a selfish purpose to serve by spreading misinformation about public utilities. Hence the need for education.

"Within the last four or five years the utilities themselves have awakened to this situation. They are meeting it by the simple expedient of telling the rest of the folks what it is all about. By various educational means they are making simple to the masses the mysteries of producing electricity and gas and turning them to the everyday uses to which they are put. They are going further and are showing where the money comes from that provides public utility service facilities and are explaining to their customers just where their dollars go and how they are spent. They are making the utility business an open book.

"All of this is having the inevitable effect. Shorn of its mystery, the utility industry is being accepted by the public, I believe, for what it is and does—an in-

dispensable public servant that is making a pretty good job of its service. The farther this educational work is carried, the better for the public as well as for utility companies, because it tends to reduce the likelihood of unfair treatment of utility companies, to the damage of the public."

AVOIDING BAD LEGISLATION

As Mr. Insull paused his listener took this opportunity to ask: "How do you consider that existing laws which are handicaps to progress can be corrected and detrimental legislation avoided in the future?"

"What I have just said," responded Mr. Insull, "is a large part of the answer to that question." Continuing, he declared: "The authority given to state commissions is far from adequate in many states. As a result there is very wide conflict between rules and regulation in different states. Abolition of tax-exempt securities would materially help in attracting to the industry the new capital necessary to meet the ever-increasing demands of the public for more utility service. State commission laws should provide that at least a portion of the members shall hold over into the succeeding governor's term so as to insure membership in these bodies of men who are already educated in the utility business. Franchises of fixed tenure should give way to indeterminate permits.

"Further education of the public in the directions already suggested, plus proper local relationship between the utility company and its customers, should be a continous policy. Elements in this proper local relationship are open and above-board dealings, proper recognition of their responsibilities on the part of employees, good service, full information to customers about the business, and proper development of the utility to meet the growing needs of the community.

"When good relations between companies and public are thus established throughout a state, and when, by the elimination of secrecy and mystery from the dealings of the companies, the public comes to understand what the utilities are and how they function, the public will not stand for harassing and hampering legislation. Politicians aim always to do only that which is popular."

Asked as to the prospects for further expansion of the industry and along what lines this should proceed, Mr. Insull hesitated for an instant.

"That question," he said, "opens up such a vista of possibilities that one scarcely dares try to visualize it. Even the most active imagination cannot conceive a limit to these possibilities. The completion of the task of linking together all the power lines of the nation is not in the far distant future. Utilization of water power is proceeding rapidly. Electrification of the steam railways is coming; its realization is contingent largely upon the time when the railroads can do the necessary financing. Farms and rural communities must be given power and utilization equipment.

"These constitute only the tiniest scratches on the surface of what the future holds for the electrical industry. The next forty years probably will surpass even the last forty, at the beginning of which even electric lighting had not become an actuality."

The next query propounded to Mr. Insull was: "What outstanding principles have been responsible for the success of the Commonwealth Edison Company that can be applied to smaller systems?"

Reviewing briefly the growth of the central-station industry in Chicago from the opening of the first plant in 1888 to its present rank as the nation's largest producer of electricity from steam power, he suggested:

Development of a wide diversity of load, thereby saving on the investment necessary to produce power for peak-load periods.

Interconnection of power-producing plants, thereby reducing the reserve capacity necessary to insure the meeting of all needs at all times.

A working out of proper methods of developing wholesale customers, thereby permitting development of the properties and a corresponding reduction in costs and rates.

Use of the best engineering talent obtainable, so obtaining a maximum of efficiency in production and distribution of power.

Last but most important, winning and retaining the confidence and sincere good will of customers.

IMPORTANCE OF DIVERSITY FACTOR

"The Commonwealth Edison Company," he added, "was not always the great concern it now is. Geography has played no small part in its growth. But not the best geographical location in the world would guarantee, or even indicate, such growth were the other elements I have cited overlooked. Today's 'little' companies may never rival the one of which I chance to be the head, but every one can anticipate success if the fundamentals are observed. In the development of diversity lies one of the real secrets of the transition of a small power-producing concern into a large one."

Questioned more specifically on the value of diversity factor, Mr. Insull referred to remarks which he made in an address before the Western Society of Engineers the early part of 1923. At that time he said that "if all the steam roads entering Chicago were electrified the sum of the maximum demands for different classes of service rendered by the Commonwealth Edison Company would be about 1,110,500 kw. compared with a coincident maximum demand of 959,500 kw.—a diversity of 151,000 kw. If you will take a saving of 151,000 kw.," he explained "and figure it out at $100 per kilowatt, which is a very low price for central-station construction at this time, and allow a 25 per cent reserve, that diversity would save an investment of $18,120,000. And if you go a little further and include the diversity that exists between the city and the country districts, that diversity is increased to about 170,000 kw. The saving from coupling up all these various organizations and from the operation of the surface and elevated lines in the city of Chicago from energy produced from the same source as for light and power, and the electrification of the entire switching area of the steam railroads—putting that all together and not figuring anything for the electrification of the steam railroads outside of the Chicago switching area, the direct investment saving, not considering the operating saving, would be upward of $20,000,000."

Mr. Insull was outspoken in his indorsement of the policy of merchandising by central-station companies. This, he explained, should be done in a spirit of friendly "co-operative competition" with the local dealers of each community. Such a spirit can be maintained only so long as the local dealer does not get the idea that the central station is possibly taking advantage of its greater financial structure to crush the small dealer through price wars or similar tactics.

"Briefly, Mr. Insull," he was asked, "what is your

attitude on interconnection, superpower and rural service?"

He pointed to a map of properties under the direction of himself and his associates which showed the manner in which the various properties are linked by interconnecting power lines, and said:

"That shows what I think and what my associates in these many companies think regarding interconnection.

"As for 'superpower'—an exceedingly 'catchy' term and one which fires the imagination—it is, in reality, nothing more than interconnection, and the map expresses my views. Here in the Upper Mississippi Valley, and radiating from Chicago, we have already largely realized what most of the talkers and writers mean when they refer to the future of superpower.'

"Regarding rural service, it is bound to come and in the comparatively near future. The farmer is entitled to it and he will get it, although realization of that approach to an industrial millennium means an immense amount of technical work by engineers—both electrical and agricultural—in working out solutions of the peculiar problems to be met."

Mr. Insull expressed the belief that the problem is being tackled in the proper way by the Joint Committee on the Relation of Electricity to Agriculture.

Mr. Insull was then asked his attitude regarding the economic importance of higher steam pressures and distillation of coal. He replied:

"Already we have adopted a boiler pressure of 600 lb. for the Crawford Avenue station. I think that in the near future we are quite likely to go to 1,000 lb. pressure. That is not any laughing matter, provided that the authorities which control such matters will permit its use. Within the next year I expect to order a unit consisting of a boiler and a small high-pressure turbine with boiler steam pressure of about 1,000 lb.

"While the use of coal for gas-making purposes has advanced to a point where the byproducts form a very important item in the cost of production, the obtaining of corresponding results in the electric power industry is by no means so far advanced. It is bound to come, however, in the near future, and the experiments in the distillation of coal, more especially around Newcastle, in the north of England, and in Germany, are bound to bring results which will add greatly to the efficiency already obtained from higher pressures and from improvements in the cycle of power production."

In concluding his remarks Mr. Insull said: "Economy and reliability are two of the secrets of succcess in all forms of business. Never for a minute cease to strive for greater economy or to establish and maintain a spotless reputation for reliability."

Recent Trends and Problems in Electrical Manufactures

Standardization and Simplification Progressing and Benefits Are in Proportion to Extension of the Program—Small Manufacturer's Place in the Industry Fully Assured, Departments in Larger Companies Now Living "On Their Own"

By E. M. Herr

President Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.
President Electrical Manufacturers' Club

WE NOW hear and read a great deal about standardization and simplification of manufactured products, and there is no doubt that the trend toward both in the electrical industry is very pronounced and will be of great importance to the industrialist, but still more so to his customers, who in this great industry are rapidly becoming almost the entire purchasing public.

It is of value to the purchaser that an electrical appliance which he purchases can be and is similar in its performance and general characteristics to those produced by other companies engaged in the manufacture of electrical products and is a part of a well-standardized product. It is also important that the line of such appliances include only those sizes and styles—as few as possible—which are essential to fulfill adequately the ordinary needs of the users; in other words, it is important that the standardized line be simplified as much as possible.

In an industry as comparatively new as that of electrical manufacturing it is natural that there should have been many calls by the users for entirely new apparatus or modifications in existing apparatus. As the manufacturing companies have progressed the needs of the users have been to a greater and greater extent covered by the standard sizes of machines and devices put on the market. There are still a great many cases where the user insists on modifications of standard product, and the pressure put upon the manufacturer to take orders for such machinery has been great. In many of such cases the needs of the customer have been reasonably met by apparatus already designed. The trend in our industry is toward the broadening of the standard lines and the lessening of the proportion of "specials" to "standards." It is to the best interest of both the user and the manufacturer that the orders for special apparatus be kept to a minimum.

How Special Apparatus Increases

From this it will be seen that the old practice of requiring special apparatus tends to increase costs in two ways, both objectionable—that is, by increasing the production of special parts and at the same time decreasing the volume of standard or duplicate manu-

facture, thus reducing the productive capacity of the factory. Exactly the opposite tendency ought to be developed and the commercial "urge" should be to encourage and induce the customer to desire the standard product.

It cannot be too strongly stated that in the long run the interests of the user will be best served by adapting existing standards to his needs. The greater the volume of sales of standard product, the cheaper the cost, which in turn brings more sales and still lower costs. When special design or construction is necessary, it should be charged for at a price fair to the customer, but, owing to the way it must be produced as compared with standard apparatus, necessarily much higher than the price of an equivalent standard machine or appliance.

Another trend which should be encouraged and pressed to more general use is that of so-called "straight-line or continuous" manufacture, or, in other words, the avoidance of the peaks of extreme demand as well as the valleys of slack and dull business. These peaks and valleys are caused by seasonable demands as well as by economic changes in business. Those caused by seasonable demands are the more easily cared for as they come at definite times and can be forecast with reasonable accuracy. The solution is adequate stocks in properly placed warehouses, which enable manufacturing to be carried on in practically constant volume and under almost ideal conditions, both for employer and employee, and at the same time render the user prompt service in filling his needs. The fluctuations in demand due to business depressions or undue business activity require much greater study and the exercise of much greater judgment, coupled with courage and financial resources. When adequately dealt with, however, the results are so good as amply to justify the necessary effort and expense.

Relative Advantage of Small and Large Maker

It is sometimes thought that the small manufacturer is at a disadvantage compared with his larger competitor. It should be pointed out, however, that the larger companies must and do bear the brunt of the very costly development necessary for the exploitation of new fields, their smaller competitors generally following, with the advantage at least of having the trail blazed for them.

Again, modern business methods do not permit profits to be sacrificed in one department and undue profits exacted in another, but each department or branch is made to stand on its own feet and ultimately justify its independent existence.

In standardized manufacture the continuous use during slack times of the facilities of the works to capacity, or as near capacity as practicable, in the manufacture for stock of parts, or in some cases the complete product, is not only extremely advantageous from the standpoint of having, when business revives, abundant stocks manufactured at low costs, but, more important still, it enables the skilled working force to be retained and greatly increases the output per unit of factory space as well as the total capacity of the plant. Many appliances in the electrical and mechanical lines can be brought to a partly finished state and then held for long periods without deterioration and to great advantage. It is along this line that much can be accomplished in cutting down the time of delivery to the user when his need arises.

The electrical manufacturing industry is completing one of the most active years of its history. Many developments, resulting in the improvement of designs in almost all lines of product, are being brought upon the market, but none of them so outstanding as to be revolutionary or materially to disturb existing methods. The development of the so-called "superpower" idea, leading to the transmission of power longer distances, and the more general interconnection of large generating plants have brought about many new problems, not only in transmission, but also in the design of control and switching appliances.

These rather unusual developments, together with the regular growth of this very virile industry, will require more than the ordinary manufacturing facilities during the year 1924. It is the aim of the electrical manufacturer to keep pace in his plant-expansion program with the rapid growth in the use of electrical machinery. Constant studies are being made to determine the probable future requirements in the various lines so that the manufacturing facilities to meet these needs may be available. So irregular and at times phenomenal is this growth that the necessary additional facilities to be provided are determined with great difficulty on account of the meager information available.

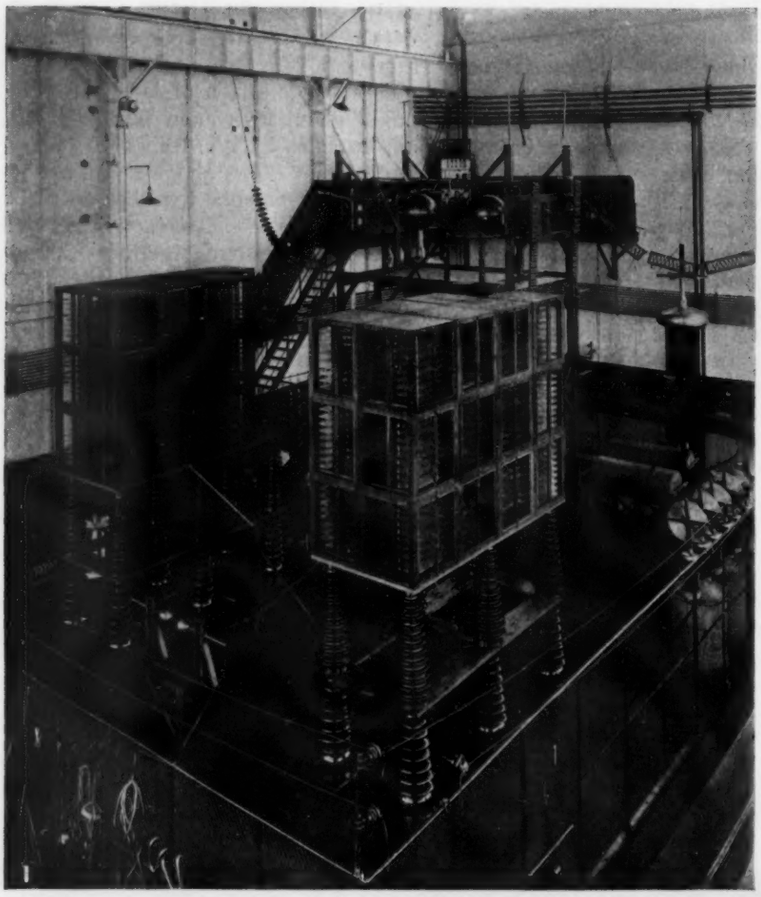
Need for Better Statistics

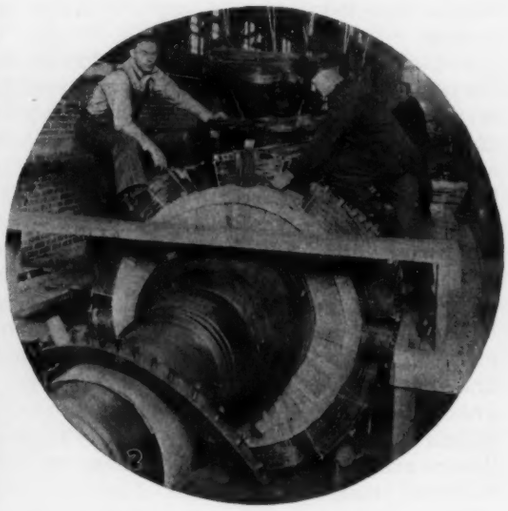
The study of the development of this great industry would be made easier and more reliable were there available promptly and regularly trustworthy and complete statistics of results. Such statistics would not only be helpful to executives in planning future extensions, but would also tend to greater economy in the industry through the greater reliability of results. Data of this kind, of great value in working up forecasts, is from time to time made available by the public utility companies and the technical press. The Department of Commerce in Washington should also be of valuable assistance in this field.

A greater field than that of large power and transmission apparatus, and in fact the largest in the industry, is that of electrical merchandising. There is a trend toward better occupation of this very large field of endeavor, and it is probable that the immediate future will witness a continuance and even improvement of this trend. In fact, so large and diversified is this part of the electrical industry that it already reaches into many of our home needs and the requirements of our everyday life, and that the magnitude of its development in the near future is difficult to overestimate.

From the above we must conclude that the development period in the electrical industry is by no means past, but that, on the contrary, we are now and probably will be for a long time in a period of extremely active growth in this industry. Not only is the entire field constantly widening in an accelerating ratio, but the appliances now in use are being improved so rapidly and changed so frequently that manufacturing is done under great difficulty and at higher costs than can be obtained when this period of change and development shall have passed. The demand for better and better performance and higher efficiency will continue, and we must accept this situation until we gradually work into the more stable designs, only possible after the period of exploitation of new fields is completed. Even during this time of progress in this wonderful art, however, the increased use of electricity is constantly pulling down the cost of light, heat and power and at the same time broadening our possibilities of accomplishment and the ease and comfort of life.

Big Things and New Things Produced in 1923



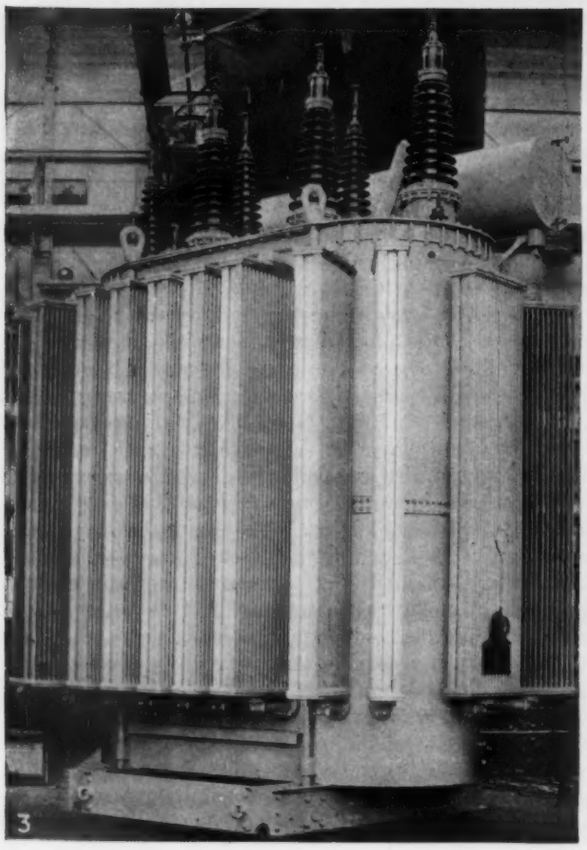


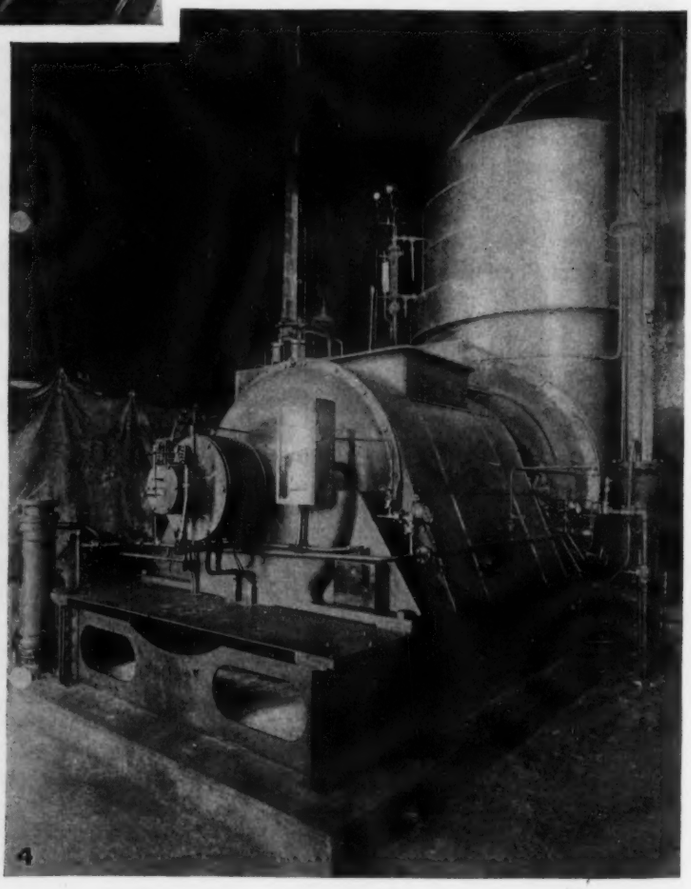
No. 1. A 2,000,000-volt lightning generator at Pittsfield created much publicity and proved very valuable in high voltage researches.

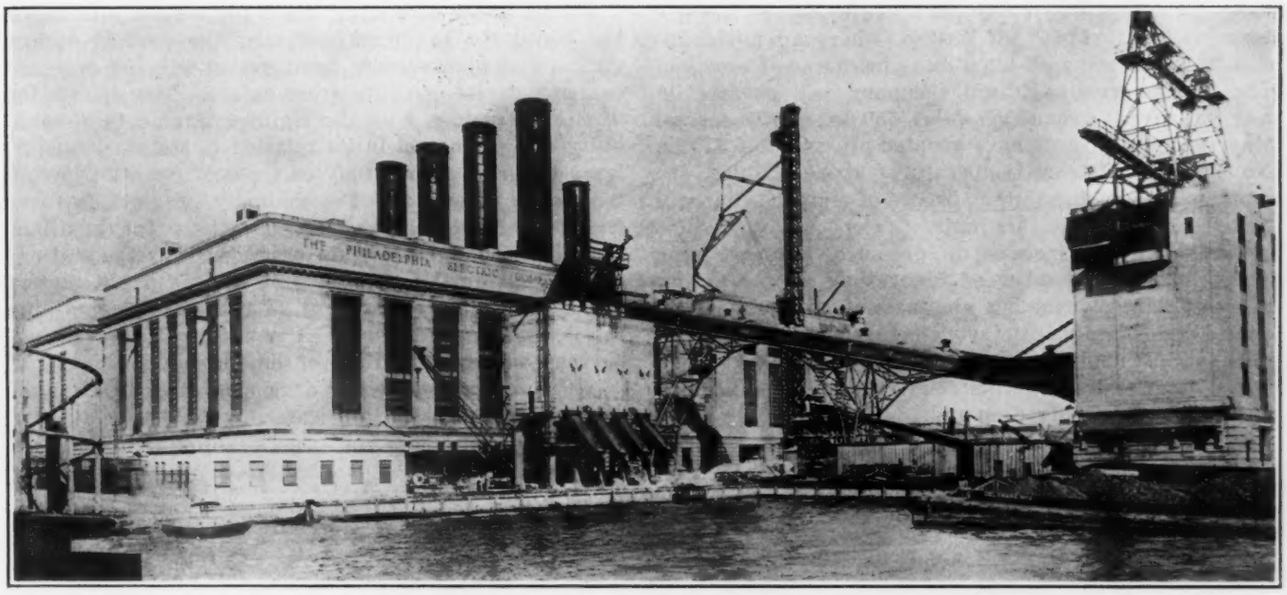
No. 2. Placing coils on the rotor of a 62,500-kva. generator installed by the Brooklyn Edison Company.

No. 3. The Kansas Gas & Electric Company installed the world's largest self-cooled transformer. Rating: 72,000/13,200-volt, 15,000-kva., 60-cycle.

No. 4. The mercury boiler and turbine at Hartford offers opportunity for economies in energy production.







Power Development in 1923

Great Advances Made in Generation, Transmission and Distribution—Importance of Cable Development—Higher Distribution Voltages Used—Future Needs and Trends

By H. P. Liversidge

Chairman National Technical Section, N. E. L. A.; Philadelphia Electric Company

THE year which has just drawn to a close marks a number of important developments in the broad field of electric power production and distribution. The developments and their importance to the industry can best be measured by considering their probable effect on the immediate future of the art rather than in terms of results accomplished during the past twelve months.

Reviewing the improvements in the art made during the last five years, it would appear that in the course of the past year a number of important departures from recognized practice, involving almost every major phase of the problem, have been initiated. It is not very difficult to account for the evolution of these developments. They are due largely to a clearer realization of the magnitude and aspect of the problems ahead, involving provisions not only for economical extensions to our great systems, but for an equally important objective—the efficient production and distribution of electrical energy. It has been difficult to realize that many companies are growing at a rate which now requires yearly extensions equal to or in excess of the total growth of their systems during the first twenty-five years of their existence.

The large yearly additions to our light and power systems and the further realization of those intimately associated with their growth that their problem will be even a greater one for the future have resulted in the initiation of changes from recognized practice which should clear the way to cope satisfactorily and efficiently with these increasingly large additions to system capacity and output.

During the year there has been an unprecedented building program of both steam and hydraulic plants, involving around 5,000,000 kva. of additional generating capacity. The largest single installation which was completed and placed in operation was the Hell Gate plant of the New York Edison Company of 300,000 kva. ultimate capacity. However, designs for several larger plants have been started during the year, the largest of which will have an ultimate capacity of 600,000 kva.

There has been no decided increase in the maximum size of individual units. However, while 30,000-kw. units have been an accepted standard, there is an indication of the use of a number of 50,000-kw. units in the immediate future, several of these machines now being in process of manufacture. Experience in the manufacture and operation of large units has resulted in marked changes and improvements, not in fundamentals, but rather in refinements of design, materials and workmanship, all of which have produced increased reliability and economy of operation.

To the use of higher steam pressures considerable attention has been given during the past year. While no installations using higher pressures have gone into operation, several plants designed for operation at higher pressures than those heretofore used in the larger plants in this country are now in course of construction. The maximum so far on record will be

used in the new Weymouth plant of the Edison Electric Illuminating Company of Boston, where an initial installation operating at 1,200 lb. is in course of erection. The Commonwealth Edison Company will operate its new Crawford Avenue plant at 550 lb., while several other projected plants have adopted pressures of 375 lb. No increase in steam temperatures above 720 deg. are contemplated, owing to the absence of material that will safely operate above this limit.

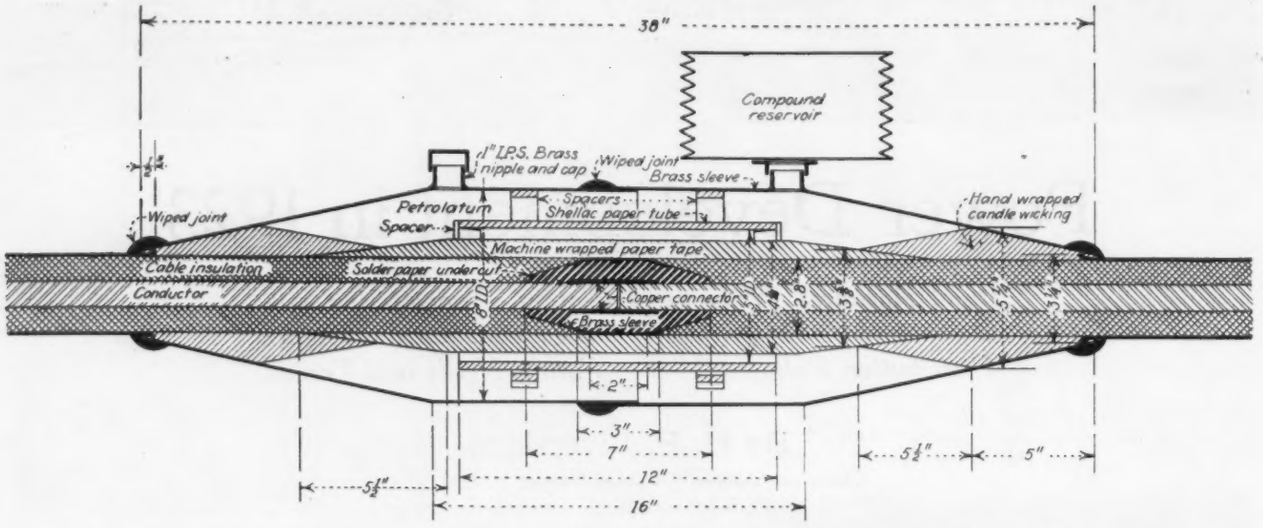
Paralleling the increase in pressure, the past year has witnessed a number of innovations in the design of new plants, involving the use of air preheaters, multi-stage bleeding and steam reheating. While no installations applying these principles have yet been placed in operation in this country, they are included in designs now being prepared.

Probably one of the past year's most interesting developments in power generation has been the installation and initial operation of the mercury boiler equipment at Hartford, Conn. This has now been in successful operation for several months and has added 1,800 kw. capacity to the existing plant.

Considerable interest has been indicated in the further extension of pulverized-fuel burning, the most noteworthy installation on a large scale being at the Cahokia plant of the Union Electric Light & Power Company, St. Louis. The present capacity of this station is 30,000 kw., and this will ultimately be increased to 240,000 kw. Satisfactory results obtained in earlier installations have warranted additions to a number of existing plants burning pulverized fuel, so that this form of coal firing for power-plant boilers bids fair to become an important factor in future design studies.

There has also been a notable increase in refinements of installation, including such equipment as de-aërators, boiler-feed-water evaporators, etc. It may be said, therefore, that the tendency of plant design during the past year has been toward a combination of equipment which would result in marked increase in efficiency of production. With rising fuel prices and the difficulty in obtaining coal of uniform grades, the necessity for consideration of such improvements is of extreme importance. The increased size of plant has the added advantage of permitting the use of designs and equipment so as to take advantage of this factor.

The adoption of electric drive for station auxiliaries has continued to increase during the past year, and virtually all plants under construction or being designed contemplate its use to a great extent. The application of electric motors, with the rigid requirements of reliability and of control in its relation to station economy, leads to an intensive study of types of motors and control for this service. The majority of stations favor the use of alternating-current motors for auxiliary service, although in certain cases, such as the stations of the Detroit Edison Company, direct-current motors are used, mainly on account of the ease of obtaining the desired speed control. A new type of alternating-current variable-speed motor having a wide range of speed control is now being developed so as to meet the requirements of a certain class of auxiliary equipment in central stations. The practice of starting station auxiliary motors on full voltage is receiving considerable attention and is being introduced in several instances.



A 66-KV. CABLE JOINT DEVELOPED BY THE ENGINEERS OF THE CLEVELAND ELECTRIC ILLUMINATING COMPANY MARKED A GREAT ADVANCE IN PREVIOUS PRACTICES

The entire question of the use of electric drive for auxiliaries is so intimately associated with heat balance that it cannot be studied independently, but must be made a part of the analysis of heat-balance conditions.

The arrangement of the switch house so that each phase will be in a separate room, which was initiated by the Commonwealth Edison Company in its Calumet station, has been adopted in large stations under construction and is also planned in a number of stations now being designed. The isolation of phases, either vertically or horizontally arranged, has required the development of new types of switching equipment. This is being pushed ahead with a view to obtaining apparatus capable of handling with safety the large amounts of energy necessary in modern stations.

The development of oil switchgear and switching equipment has resulted in wide departures from standard practice.

The increased capacity of recent generating stations makes it necessary to provide means to limit the effects of disturbance due to failure of equipment. For this purpose the use of current-limiting reactors is increasing. In addition to installing the reactors on outgoing lines they are being used to a certain extent on generators and in nearly all cases to sectionalize the station buses.

The past year has shown a marked increase in the number and size of outdoor high-voltage switching and transforming equipments. Uniformly satisfactory results have thus far been obtained, so that this development in station design may be regarded as standard practice. The attention of engineers is now being directed toward the possibility of placing switching and transforming equipment for distribution substations outdoors, which, under certain conditions, would lead to a reduction in investment costs and give equally satisfactory operating results.

Developments in hydro-electric plant equipment are following the general trend of steam plants both in improvement of design and construction and in size of units.

Three 70,000-hp. turbines are being built—one of them, in fact, has just gone into operation—for the Niagara Falls Power Company and will be the largest in the world. They are to operate under a head of 213½ ft. at a speed of 107 r.p.m. Three other large units, each of 55,000 hp. under a 305-ft. head, are also under construction for the Queenston station of the Hydro-Electric Power Commission of Ontario.

Improvement in design in draft tubes with central core starting from the runner has given notable results and increased efficiency over a wide range of load and conditions.

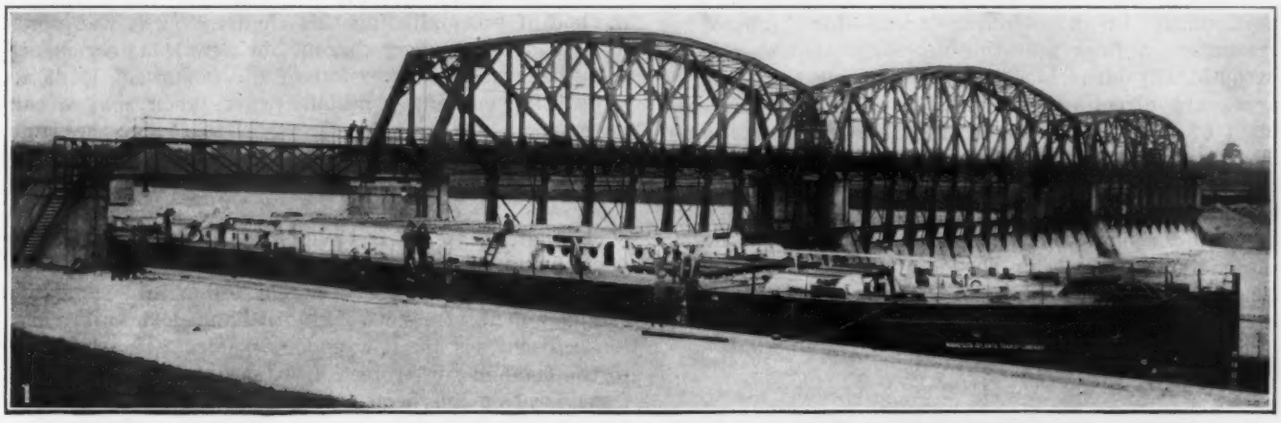
Installations with high-speed propeller turbines are increasing rapidly in number as well as in size. Four units, each rated at 30,000 hp., for the St. Maurice Power Company, operating under a 60-ft. head at 120 r.p.m., and two 25,000-hp. units for the Manitoba Power Company for a 56-ft. head and a speed of 138.5 r.p.m., are notable advancements in the field of turbine design and seem to justify—from the results obtained—the expectation placed in this type of runner, which is especially adapted for operation under a wide range of heads and applicable to units of large capacity.

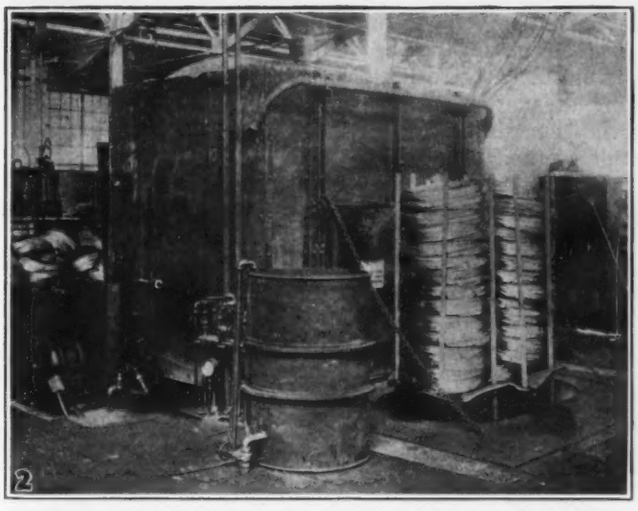
An interesting installation of two 12,000-hp. turbines, with ejectors, to operate under a normal head of 60 ft. is being built for the Hollinger Consolidated Gold Mines. The purpose of the ejectors is to increase the power output by the use of surplus flow during times of high tail-water and resulting lower head.

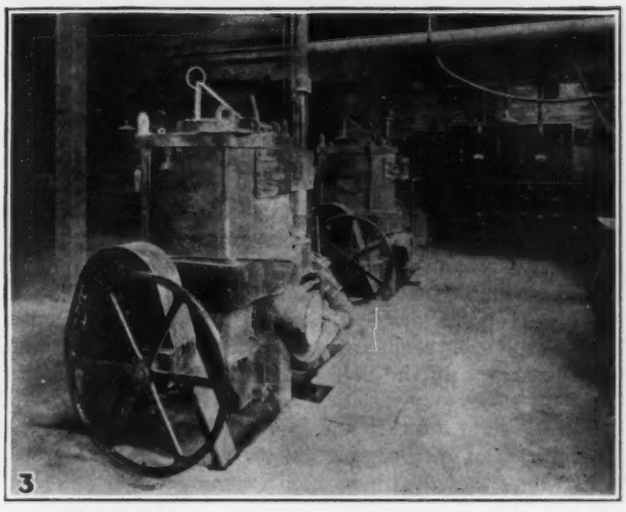
There is every indication of a complete abandonment in future designs of hydro-electric plants of the use of the horizontal type of turbine. It has been supplanted by the vertical-shaft, single-runner type, in almost every case, owing to the increased simplicity, dependability and efficiency of the latter type.

Exhaustive tests were conducted on various types of draft tubes, and the results obtained indicate decided advantages in favor of the spreading type and siphon setting.

In the field of power transmission two notable examples of advance in development are the successful operation of the 220-kv. transmission on the Pacific Coast and the 66-kv. underground, single-conductor in-







THREE NEW DEVELOPMENTS OF INTEREST

No. 1. Diesel electric motor-driven barge, "Twin Ports."
No. 2. Electric furnace for bright annealing copper wire.
No. 3. A 1,200-lb. repulsion-reduction furnace for melting brass marks a new record in melting capacity.

stallation on the line from Cleveland to Akron. This latter installation, while not yet in actual operation, bids fair to come up successfully to the expectations of the engineers responsible for its layout.

It would seem difficult to predict the progress which will be made during the next few years in the utilization of high voltages for transmission of power in bulk. The enormous growth of the central-station loads makes it apparent that there is urgent need for further investigation and experience on voltages even higher than the maximum recently placed in operation. Higher generating voltages will probably also be a feature of large central stations in the near future.

The increasing difficulty in securing rights-of-way—particularly in metropolitan areas—for high-voltage transmission lines and the necessity of transmitting exceptionally large blocks of power over these limited areas are directing greater attention to the development of cables for voltages of 66 kv. and even higher. The experience gained in the study of cable manufacture and its installation during the past year has indicated that the solution of the problem lies largely in the care exercised in the manufacture of the cable and in the method of making the joints. These needs are clearly recognized today, and the results thus far indicate that their attainment is well within the limits of practical design and manufacture.

HIGH-VOLTAGE CABLES NECESSARY

Investigation of the characteristics of paper and compounds used in cable manufacture has been greatly stimulated during the past year by the increasing demands for higher-voltage cables and the greater emphasis placed on the importance of reliability of this major link in central-station systems. Comparative study of foreign cable practice and searching investigation of domestic methods of manufacture and of the problems of insulating materials are resulting in the development of greater precision and reliability in both manufacture and joint making. While 66,000-volt single-conductor cable will soon be an assured fact, there is foreshadowed a demand for cables of even higher voltage, requiring a continued intensive and wider research in the field of cable manufacture, in its installation and operation.

Considerable interest has been shown in the practical possibilities of interconnection between systems in sections where the advantage of interconnection in the past has not been so apparent. Such interconnection cannot always be justified, as, for instance, where there is little, if any, diversity between the loads supplied, where the intervening distances are large, or where the loads are not of great magnitude and there is no marked lack of power supply in the various areas. However, there are many districts, particularly in the eastern sections of the country, where interconnection would effect considerable savings to all the operating companies concerned, and it is these areas that are now receiving a great deal of attention. Unfortunately, the advantages and possibilities of interconnection have been greatly overestimated, and while general studies have been made in many parts of the country, the movement toward a definite co-ordination of the diversified elements of the problem will probably proceed only as rapidly as the economics of the problem will justify.

The intensive load development, particularly in metropolitan areas, during the past year has contributed largely to the progress in power distribution. There has been a marked tendency toward the wider use of voltages of 6,600 and 13,200 for direct power distribution. The advantages of these voltages include in many cases marked savings in first cost, operating economies and a higher degree of reliability of service. This progress applies very largely to overhead power distribution, and it is believed that the greater application of underground distribution depends largely upon the development of underground protective equipment of more reliable characteristics.

There has been a marked tendency in a number of metropolitan areas—in districts previously supplied with direct current—toward the installation of alternating current, secondary distribution. The present method of accomplishing this change-over is the introduction of alternating current for new load increments and the gradual conversion of direct-current loads to alternating current, especially where such change can be economically justified. In order to render the same degree of service with an alternating-current system that is generally obtained by a direct-current network, the necessity of very careful, thorough engineering load studies has become evident. It has required the development of newer types of subway protective equipment for alternating current in order to permit the establishment of a network with banked transformers. Several schemes are now under consideration in answer to the demand for protection of service and equipment. Consideration has been given to three-phase, four-wire secondary distribution as a possible means of obtaining a universal voltage for combination light and power loads. The advantages of this type of distribution can be most nearly realized with the initial installation of an alternating-current system. Where satisfactory conditions exist serious consideration has been given to this method of distribution.

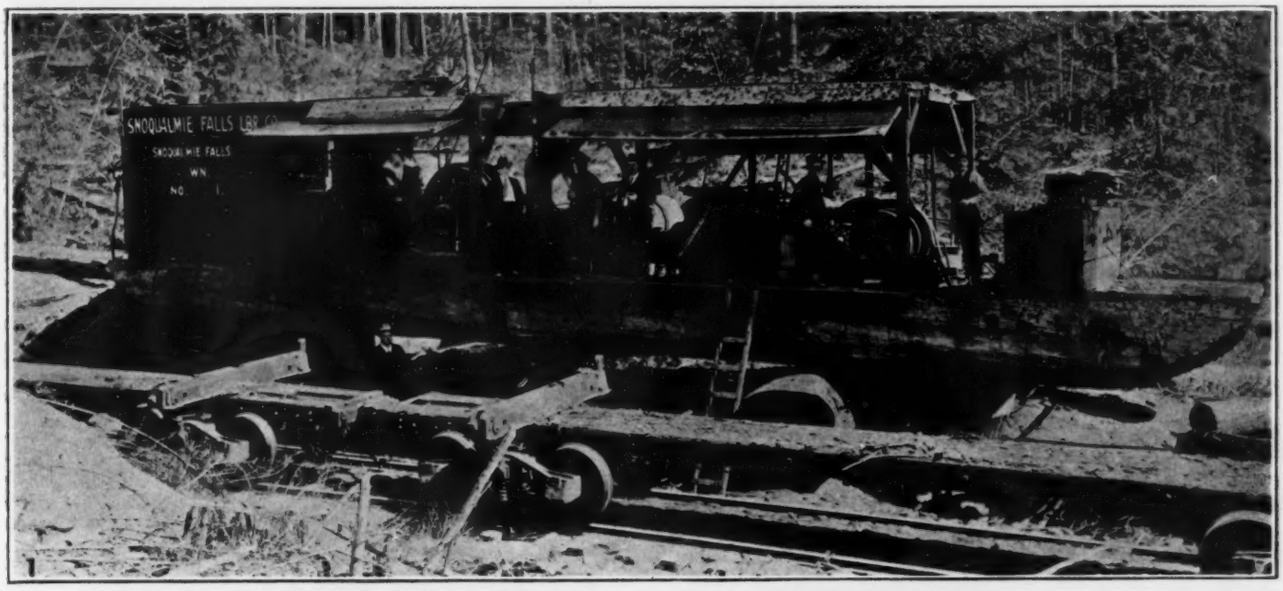
The greater concentration of power on a number of distribution systems, the greater insulation for higher-voltage distribution and the advantages of interconnection are all questions directing the attention of engineers to the application of remotely controlled equipment on distribution systems for sectionalizing high-capacity distribution circuits.

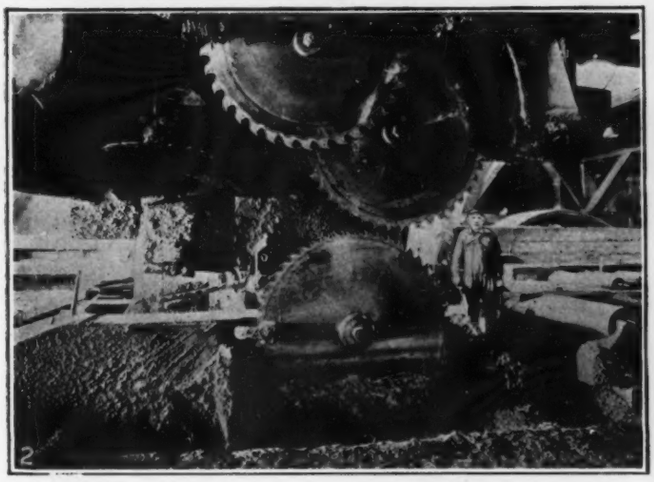
There has been a wider recognition of the distinction between the rating of distribution transformers for manufacture and purchase and the rating of such transformers as units, operating under widely different load and temperature conditions. The development and application of reliable temperature indicators co-ordinated with load testing has permitted the operation of distribution transformers on a temperature basis, with a resultant saving in transformer investment for the supply of loads having a low load factor.

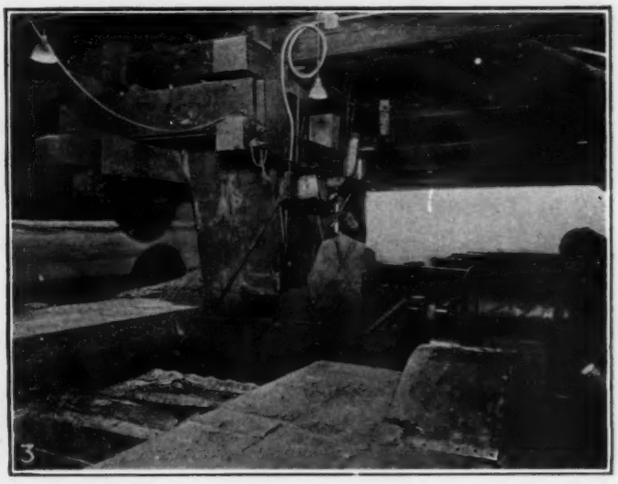
The necessity for more efficient utilization of distribution systems has brought about a greater study of the principles underlying the design of underground duct systems. To this field of study comparatively little attention has been given in the past, but the congestion of city streets and increasing loads and load factors are pointing out the necessity for a more definite practice of operating duct and cable systems on a temperature basis.

Looking into the future, one cannot fail to recognize that the growth of our industry is proceeding at an extraordinarily rapid rate. The demands for increased power are requiring the production of apparatus and its installation under a pressure which presents elements of danger. It is not sufficient that we

meet the demands placed upon the industry today; they must be carried out with a view toward permanence and stability of investment, to be made in the most economical manner and capable of producing energy and distributing it at a minimum cost. There is a possible danger that to keep pace satisfactorily with the demands many steps may be taken which in the light of future experience may unnecessarily burden the industry. There is urgent need today for more intensive research and study, more careful analysis and co-ordination of results in every phase of the problem, has been little change of a radical nature in our methods. Both overhead and underground systems have been able satisfactorily to cope with the yearly normal increase in power in the particular territories served. Today we are facing conditions which seem to have changed almost overnight, requiring the supply of unusually large individual loads both in amount and number and presenting problems of an entirely different nature which call for solution in an economical manner and one according with the projected growth in the immediate future. The answer is not merely higher volt-







ELECTRICITY HAS INVADED THE LUMBER INDUSTRY

No. 1. Electric yarder and duplex log-loading outfit installed at the Snoqualmie Falls Lumber Company, Washington. The application of electrical apparatus to logging work is of comparatively recent origin, but is rapidly growing in favor.

No. 2. Fastest "head rig" in the world saws 250,000 ft. b.m. per day at the Inman Poulsen Lumber Company plant in Portland, Ore. A 500-hp. motor is connected to two 60-in. head saws.

No. 3. A close-up of the head saws.

in order to safeguard against the errors which are usually the sequence of too hasty development. In point of magnitude of operation there has been no period in the history of the growth of the industry which is comparable with the present, and this affects all phases of the development of power-producing plants—the generating plants and the transmission and the distributing systems. Of these problems, however, the one which appears of most importance today is the problem of satisfactorily distributing these enormous load increases.

Looking back over the growth of the industry, there ages or additional circuits, for there are also added the problems of system standardization and the adoption of control, protective and sectionalizing equipment which will guarantee a satisfactory service. To the problem of system design and economical extensions must be added the problem of efficient operation, and it is a healthy sign to note that during the past year greater attention was given to the establishment of operating budgets and to the details of operation involved in the efficient and economical management of our large systems. The future of the industry depends on these fundamentals.

Remarkable Achievements Have Been Recorded in California

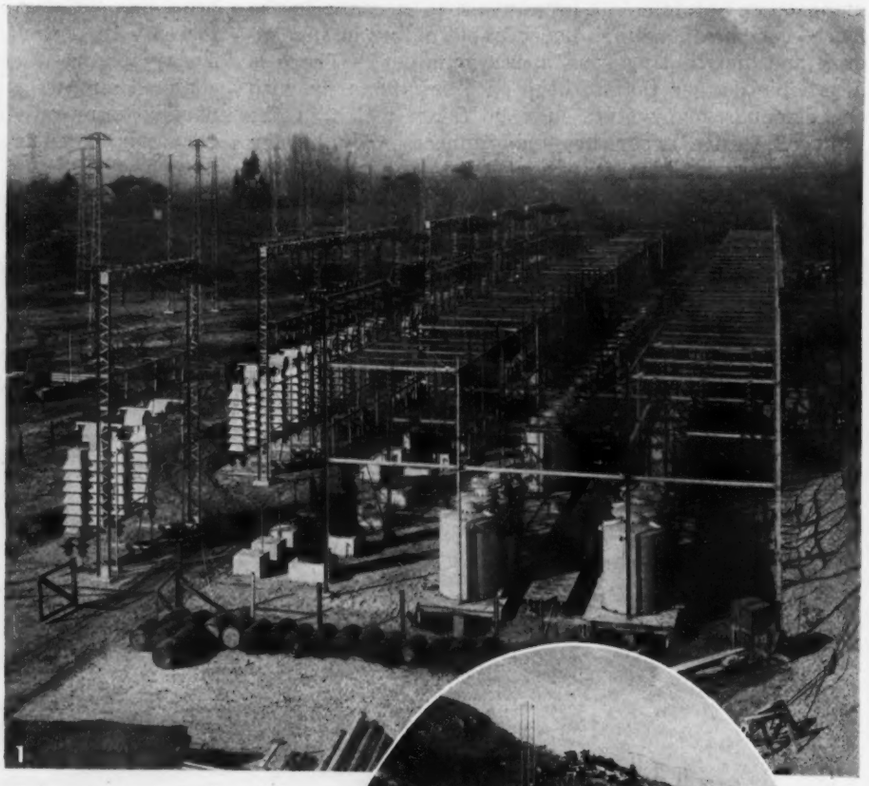
No. 1. A 220,000-volt, solidly grounded, neutral three-phase outdoor station of the Southern California Edison Company at Eagle Rock, showing circuit breakers, lightning arresters and transformers.

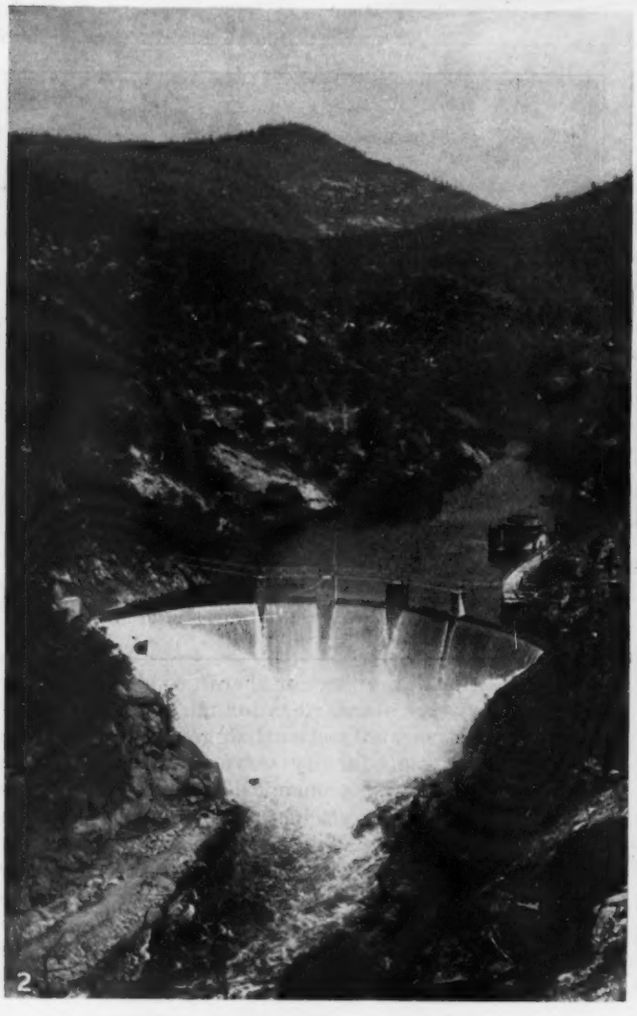
No. 2. Concrete diversion dam on the San Joaquin River, Cal., for the new 100,000-hp. plant of the Southern California Edison Company recently placed in operation. A 6-mile tunnel, more than 20 ft. in diameter, conveys the water from this reservoir to the plant. The next step in the Big Creek development of the Southern California Edison Company will probably be the construction of the 2A plant to operate under a head of approximately 2,400 ft. The ultimate development on the Big Creek-San Joaquin project will be about 1,400,000 hp., at a development cost of $300,000,000.

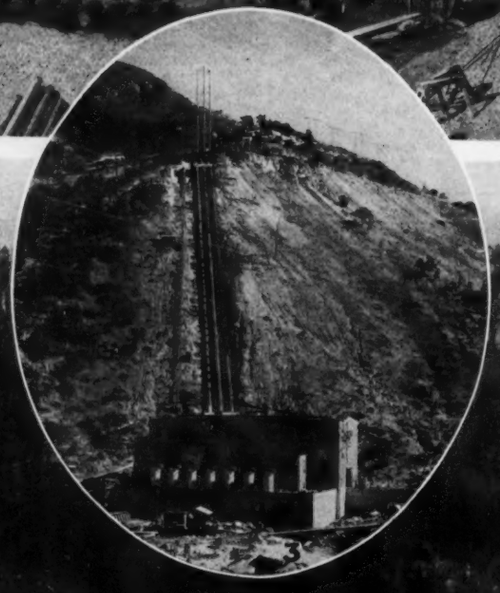
No. 3. Big Creek No. 3 of Southern California Edison Company. During 1923 100,000-hp. was placed in operation.

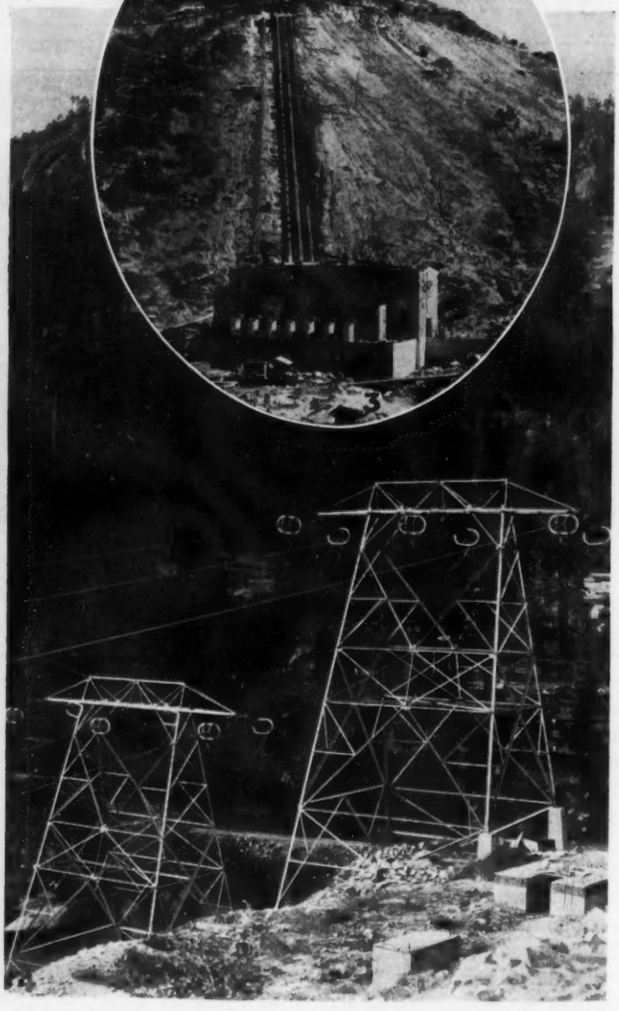
No. 4. Two 220,000-volt lines are in operation. Dead-end type towers in the high Sierra on the 220,000-volt, 270-mile transmission line of the Southern California Edison Company. A 100-mile section of this line is now in full automatic operation of the 220,000-volt oil circuit breakers with very gratifying results. Flashovers which have occurred on this section of the line have been cleared by the operation of the circuit breakers without serious operating difficulty. The remainder of the line is to be placed under full automatic operation of the circuit breakers in the very near future.

The Pacific Gas & Electric Company also has installed a 220,000-volt line in the San Francisco district.









Looking Ahead Ten Years

Survey Made by the "Electrical World" Indicates Startling Growth in the Next Ten Years—The Energy Generated Will Triple—Gross Revenue Will More than Double—Customers Will Spend Billions of Dollars for Appliances

By Robert M. Davis
Statistical Editor "Electrical World"

AMERICAN industry and the American family have adopted electrical energy as a source of light, heat and power with such enthusiasm that today the electric light and power industry stands out as one of the greatest economic factors of the nation. But the present use of electrical energy in this country dwindles into small proportions when a study is made of the probable future use of this great force of nature. It is estimated that in 1933 more than one hundred and twenty-five billion kilowatt-hours of electrical energy must be generated by the central generating plants of the country to meet the demands of customers for electrical service in the home, on the farm and in the mine and factory. To meet this demand the central-station generator rating must be increased by 32,418,000 kva., involving an expenditure of more than six billion dollars. And these figures are believed to be conservative.

Statistics of the past—and, in fact, those showing the present status of the central-station industry—are valuable mainly in their probable bearing on future development. It is the future, what it holds in store and what it will demand, that is of interest to the industry at large. With a view toward presenting as comprehensive a picture as possible of the developments which will probably take place in the industry during the next five-year and ten-year periods, the ELECTRICAL WORLD in the past year requested operating companies representing about 80 per cent of the installed generator rating of the country to estimate the probable growth in the operations of their companies. The response exceeded all expectations. Some of the companies were already making their own individual studies, and others were spurred to action by this request. In all cases extra work was done by the companies, which realized the value of nation-wide totals of these figures, and large sums of money were undoubtedly spent in compiling the estimates.

Based upon this composite picture of growth an estimate has been made for the industry as a whole by sections of the country and for the various groups of items entering into central-station operations. An estimate has also been made of the value of electrical appliances and supplies which will be purchased by central-station customers. All these estimates will be found included in the accompanying tables.

It must be borne in mind that these figures do not include the additions and extensions to purely electric railway generating systems or to private or isolated generating plants. Nor do they include the value of purchases of electrical appliances and supplies which will be made by mines and factories using privately generated energy.

The composite picture of the industry's growth in the various sections of the country is undoubtedly based upon operating conditions as they exist at the present time or as they can with full confidence be definitely anticipated. Developments in interconnection, super-

Table I—Estimated Amounts Which American Public Will Invest for Advantages of Electric Service

Section	1924			1925		
	Value of Extensions to Generation, Transmission and Distributing Systems	Value of Electrical Apparatus and Supplies Purchased by Central-Station Customers	Gross Revenue of Central Stations from Sale of Energy	Value of Extensions to Generation, Transmission and Distributing Systems	Value of Electrical Apparatus and Supplies Purchased by Central-Station Customers	Gross Revenue of Central Stations from Sale of Energy
New England	$45,490,000	$206,900,000	$121,000,000	$40,515,000	$204,600,000	$133,000,000
Middle Atlantic	169,109,000	621,100,000	333,500,000	168,528,000	612,100,000	377,500,000
South Atlantic	55,009,000	247,100,000	176,000,000	47,833,000	224,700,000	191,300,000
E. No. Central	139,499,000	684,100,000	360,400,000	132,394,000	616,800,000	400,500,000
W No. Central	41,541,000	180,400,000	115,800,000	45,767,000	204,700,000	128,200,000
E. So. Central	15,598,000	63,100,000	49,000,000	14,448,000	55,800,000	52,300,000
W. So. Central	15,183,000	53,000,000	51,200,000	12,513,000	46,500,000	54,200,000
Mountain	21,423,000	93,200,000	51,400,000	21,415,000	92,400,000	56,500,000
Pacific	52,158,000	204,000,000	105,200,000	52,524,000	231,700,000	116,000,000
United States	$555,010,000	$2,352,900,000	$1,363,500,000	$535,938,000	$2,289,300,000	$1,509,500,000
	From 1923 to 1927, Both Inclusive—(Five Years)			From 1923 to 1932, Both Inclusive (Ten Years)		
New England	$203,823,000	$1,013,300,000	$664,600,000	$401,868,000	$2,216,000,000	$1,628,230,000
Middle Atlantic	884,782,000	3,304,100,000	1,901,800,000	1,987,528,000	7,378,600,000	4,929,800,000
South Atlantic	269,107,000	1,165,000,000	960,900,000	581,895,000	2,403,100,000	2,403,100,000
E. No. Central	690,443,000	3,239,200,000	1,999,400,000	1,559,732,000	7,650,500,000	5,154,000,000
W. No. Central	214,399,000	1,011,700,000	645,500,000	456,502,000	2,387,400,000	1,649,700,000
E. So. Central	75,917,000	334,000,000	260,900,000	153,499,000	775,100,000	619,700,000
W. So. Central	67,597,000	263,300,000	270,700,000	133,937,000	599,500,000	625,700,000
Mountain	126,065,000	513,000,000	284,500,000	251,328,000	1,147,700,000	714,100,000
Pacific	261,049,000	1,116,600,000	583,550,000	625,131,000	2,950,500,000	1,530,600,000
United States	$2,788,681,000	$11,960,200,000	$7,571,185,000	$6,151,420,000	$27,947,700,000	$19,254,930,000

power plants, involving the consolidation of small electric plants in the smaller cities into larger groups, and intensive growth in hydro-electric development may change the accompanying figures materially, especially in some sections of the country. The data for the next four years, however—that is, through 1927—should indicate very clearly the probable growth of the industry, since it is entirely possible, excepting in rare cases, for companies to prognosticate local conditions for that period of time. Developments from 1927 through 1932 must be considered merely to represent the best judgment of the industry, subject in many cases to correction in order to accord with developments now interminable or which are totally unexpected.

Capital Involved in the Future Growth of the Central Station Industry

	Jan. 1, 1923 to Jan. 1, 1928	Jan. 1, 1923 to Jan. 1, 1933
Value of extensions to steam-electric generating plants	$1,101,591,000	$2,517,930,000
Value of extensions to hydro-electric generating plants	440,240,000	940,100,000
Value of extensions to transmission systems	566,130,000	1,090,750,000
Value of extensions to distribution systems ..	680,720,000	1,602,640,000
Total new capital needed by the central-station industry	$2,788,681,000	$6,151,420,000

The constantly increasing necessity for intensive studies in superpower development and in the development of the waterpowers of the country is evident from Tables IV, VI and VII. The present investigation indicates that the connected load of the central station will be increased by 23,046,000 kw. from the first of 1923 to the end of 1927. Of this amount, 7,957,000 kw., or 34.5 per cent, is connected lighting load and 15,089,000 kw., or 65.5 per cent, is connected power load. So far as known, this is the first time that a tabulation of the central-station connected light and connected power load has ever been assembled.

To handle this increase in central-station connected load will require an increase in the installed generator rating of 14,375,000 kva. during the five-year period. And it is of real interest to note the division between hydro-electric and steam-electric which makes up this 14,375,000 kva. It has been stated on good authority that for best operating economy the installed water-power should be from 50 per cent to 75 per cent of the total installed rating required, and that the energy generated by water-power plants should be much larger than that from steam power. Naturally, this assumes that there is water power available for practicable development to this extent. In order to make the water-power and steam-power installed generator ratings approximately equal by 1928, the additional 14,375,000 kva. installed should be approximately 10,600,000 kva. in water power and 3,800,000 kva. in steam power. This is, of course, a general figure for the United States and will vary for different sections.

At present the water-power rating of central stations is about 33 per cent of the total. As indicated in Tables VI and VII the probable future developments now contemplated are not the 10,600,000 kva. of increased water power, but only 3,404,000 kva., and instead of 3,800,000 kva. in steam plants, there is 10,971,000 kva. In other words, the indicated development is exactly the reverse of that which, from the standpoint of operating economy, is considered best. But capital costs are at least as controlling as operating costs, and it is well known that capital costs in hydro-electric development are high. Nevertheless, intensive superpower agitation, such as that instigated by Secretary Hoover last fall, may change these plans considerably. Still the time is short for any extensive hydro-electric developments during the next four years beyond those now planned and indicated in Table VII. The period from 1927 to 1933 should see unusual accomplishments in superpower developments that may materially alter the figures given in Tables VI and VII for that period.

According to the estimates of generating capacity to be added, the greatest increase in central-station generator rating will take place in the Middle Atlantic States, with an estimated increase of 4,106,000 kva. during the five-year period from Jan. 1, 1923, to Jan. 1, 1928, and 8,696,000 kva. for the ten-year period ending Jan. 1, 1933; but the East North Central States follow very closely with 3,971,000 kva. for the five-year period. The Pacific States will increase their hydro-electric

Table II—Central-Station Billings from Sales of Electrical Energy Should Total Almost Twenty

Sections	1902	1907	1912	1917	1919	1920	1921	1922	1923	1924	1925
New England..	$10,504,000	$18,123,000	$28,457,000	$52,460,000	$63,890,000	$84,570,000	$89,050,000	$97,890,000	$109,100,000	$121,000,000	$133,000,000
Middle Atlantic....	29,410,000	55,379,000	87,259,000	149,692,800	193,300,000	206,800,000	225,000,000	250,600,000	288,300,000	333,500,000	377,500,000
South Atlantic	3,494,000	7,480,000	15,980,000	30,081,000	80,170,000	103,120,000	129,400,000	144,370,000	159,500,000	176,000,000	191,300,000
E. No. Central	16,865,000	34,141,000	63,390,000	114,821,000	170,000,000	220,000,000	242,000,000	273,400,000	312,000,000	360,400,000	400,500,000
W. No. Central	7,287,000	15,201,000	28,948,000	50,816,000	58,530,008	75,840,000	84,000,000	94,630,000	104,800,000	115,800,000	128,200,000
E. So. Central	2,476,000	4,542,000	7,473,000	13,514,000	25,550,000	32,320,000	36,550,000	40,100,000	44,300,000	49,000,000	52,300,000
W. So. Central	3,697,000	7,260,000	12,210,000	19,171,000	28,220,000	35,730,000	40,470,000	44,200,000	47,600,000	51,200,000	54,200,000
Mountain.....	4,127,000	8,505,000	13,850,000	26,079,000	33,550,000	39,290,000	40,100,000	41,740,000	46,500,000	51,400,000	56,500,000
Pacific.....	6,324,000	18,982,000	30,818,000	45,424,000	67,450,000	79,290,000	80,660,000	86,950,000	95,250,000	105,200,000	116,000,000
United States..	$84,184,000	$169,613,000	$288,385,000	$502,058,000	$720,660,000	$876,960,000	$967,230,000	$1,073,880,000	$1,207,350,000	$1,363,500,000	$1,509,500,000

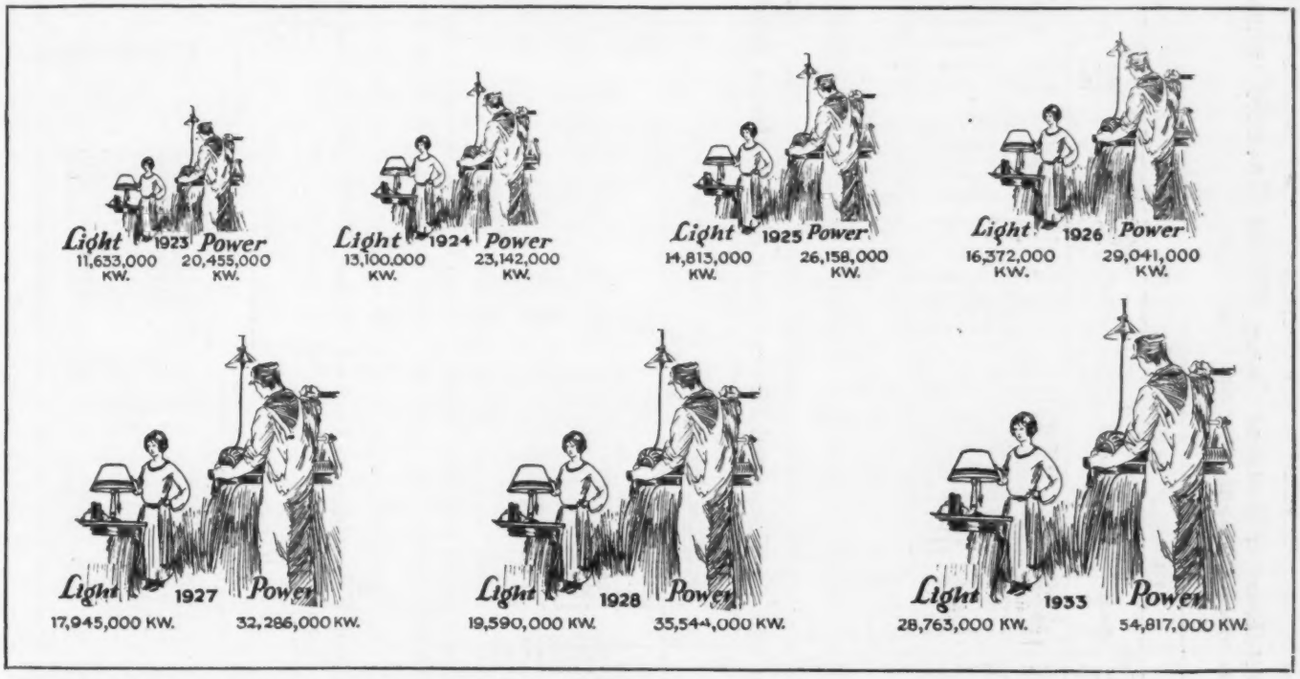
installations by 1,000,000 kva. by 1928, the Middle Atlantic States and the South Atlantic States following with 733,000 kva. and 565,000 kva. respectively. Additions to steam-electric generating systems will total 3,826,000 kva. by 1928 in the East North Central States and 3,373,000 kva. in the Middle Atlantic States for the same five-year period. The capital required for these additions and extensions to the generating plants of the country is discussed elsewhere in this article.

ENERGY GENERATED WILL TRIPLE IN THE NEXT TEN YEARS

According to data furnished by the United States Census Bureau from its survey of central stations taken at the beginning of 1923, the electric light and power generating plants of the country produced 38,288,300,000 kw.-hr. of electrical energy during 1922. This figure does not include the energy generated in plants of electric railway companies, which totaled 7,019,224,000 kw.-hr. during 1922. This figure for central-station energy generated must not be confused with the ELECTRICAL WORLD figures for central-station output, an estimate for which will be found elsewhere in this issue. The ELECTRICAL WORLD figures include energy which is purchased by the distributing companies from other public utilities for resale and is, therefore, considerably in excess of the Census Bureau figures for energy generated. Nor, for the same reasons, is it possible to compare the ELECTRICAL WORLD figures on gross revenue from sale of energy, as given in Table II, and the Census Bureau figures on energy generated.

As indicated in Table III, it is estimated that the electrical energy generated in plants of electric light and power companies will total 77,504,000,000 kw.-hr. in 1928, an increase of 75.5 per cent from 1923 to 1928, and will total 126,255,000,000 kw.-hr. in 1933, or an increase of 186 per cent for the ten-year period.

The energy generated by the central stations during 1923, as estimated by the companies reporting in this survey, was 15.2 per cent greater than that generated in 1922. This figure is slightly lower than that reported by the United States Geological Survey, but it must be remembered that the Geological Survey figures include electric railway plants as well as a few other generating systems, such as plants of the Reclamation Service, which are not classed by the Census Bureau as central stations. This lower rate of growth as estimated by the companies themselves indicates the conservatism which pervades all the figures in the accompanying tables. This rate of annual growth over the previous year (15.2 per cent) will decrease fairly uniformly until by 1928 it will be only 10.4 per cent and in 1933 only 10.0 per cent. This slowing down in the yearly percentage gain is not at all indicative, however, of the fact that the actual yearly growth of the industry is on the decrease. On the contrary, the actual growth in kilowatt-hours generated in 1928 as compared with 1927 will be over a billion units greater than the growth of 1923 as compared with 1922. The frequently expressed belief that the output of the industry doubles every four or five years cannot longer be held, and as the total amount of energy generated increases, this



THE INDICATIONS ARE THAT FOR THE NEXT TEN-YEAR PERIOD THE CENTRAL STATIONS' CONNECTED POWER LOAD WILL SHOW A SLIGHTLY HIGHER RATIO OF INCREASE THAN THE CONNECTED LIGHTING LOAD

...illions of Dollars During the Next Ten-Year Period

1926	1927	1932	Aggregate of Yearly Gross Revenue from 1923 to 1927, Both Inclusive	Aggregate of Yearly Gross Revenue from 1923 to 1932, Both Inclusive
...144,700,000	$156,800,000	$214,500,000	$664,600,000	$1,628,230,000
426,500,000	476,000,000	714,000,000	1,901,800,000	4,929,800,000
208,800,000	225,300,000	336,700,000	960,900,000	2,403,100,000
441,500,000	485,000,000	738,500,000	1,999,400,000	5,154,000,000
141,700,000	155,000,000	234,800,000	645,500,000	1,649,700,000
55,800,000	59,500,000	81,000,000	260,900,000	619,700,000
57,200,000	60,500,000	78,700,000	270,700,000	625,700,000
62,500,000	67,600,000	100,000,000	284,500,000	714,100,000
127,400,000	139,700,000	230,000,000	583,550,000	1,530,600,000
...466,100,000	$1,825,400,000	$2,728,200,000	$7,571,850,000	$19,254,930,000

Table III—Over One and a Quarter Hundred Billion Kilowatt-Hours of Electrical Energy Will Be Generated Annually in Central Stations by 1933

(Does not include electrical energy generated in electric railway plants)

Millions of Kilowatt-Hours

Section	1902, Kw.-hr.*	1907, Kw.-hr.*	1912, Kw.-hr.*	1917, Kw.-hr.*	1922, Kw.-hr.*	1923 Kw.-hr.	1923 Per Cent Gain Over 1922	1924 Kw.-hr.	1924 Per Cent Gain Over 1923	1925 Kw.-hr.	1925 Per Cent Gain Over 1924	1926 Kw.-hr.	1926 Per Cent Gain Over 1925	1927 Kw.-hr.	1927 Per Cent Gain Over 1926	1928 Kw.-hr.	1928 Per Cent Gain Over 1927	1933, Kw.-hr.	Per Cent Increase 1923-1928, Inclusive (Five Years)	Per Cent Increase 1923-1933, Inclusive (Ten Years)
New England	247.7	473.8	865.4	1,835.6	2,966.3	3,384.0	14.2	3,833.0	13.2	4,276.0	11.7	4,750.0	10.8	5,223.0	10.0	5,680.0	8.8	8,200.0	67.8	142.2
Middle Atlantic	1,021.6	2,009.3	3,548.6	7,659.3	9,998.8	11,620.0	16.3	13,300.0	14.4	15,150.0	13.9	17,200.0	13.6	19,500.0	13.4	21,900.0	12.2	41,700.0	88.6	258.6
South Atlantic	103.0	266.4	729.9	1,745.3	2,642.0	3,020.0	14.2	3,400.0	12.4	3,790.0	11.4	4,176.0	10.3	4,600.0	10.1	5,060.0	10.0	8,100.0	66.7	168.5
E. No. Central	475.1	1,075.9	2,527.9	5,757.2	9,137.3	10,770.0	17.8	12,540.0	16.4	13,800.0	10.2	15,050.0	9.1	16,400.0	8.9	17,820.0	8.7	26,800.0	65.5	148.7
W. No. Central	169.9	386.2	712.6	1,776.5	3,057.6	3,370.0	10.4	3,720.0	10.2	4,100.0	10.1	4,510.0	10.0	4,950.0	9.9	5,440.0	9.8	8,570.0	61.3	154.2
E. So. Central	73.6	118.6	227.7	1,048.8	1,392.4	1,573.0	13.1	1,718.0	9.2	1,872.0	9.0	2,020.0	7.8	2,170.0	7.6	2,330.0	7.4	3,210.0	48.2	104.0
W. So. Central	80.2	138.8	233.9	482.6	1,044.2	1,134.0	8.5	1,224.0	8.0	1,314.0	7.3	1,400.0	6.6	1,480.0	5.8	1,554.0	5.0	1,925.0	37.0	69.6
Mountain	145.8	381.0	845.4	2,036.2	2,972.5	3,640.0	22.3	4,430.0	21.8	5,370.0	21.2	6,300.0	17.2	7,240.0	14.9	8,160.0	12.9	11,700.0	124.2	221.2
Pacific	189.9	1,012.2	1,877.7	3,096.8	5,077.2	5,650.0	11.2	6,276.0	11.2	6,976.0	11.2	7,750.0	11.1	8,610.0	11.1	9,560.0	11.1	16,050.0	69.4	184.0
United States	2,506.8	5,862.2	11,569.1	25,438.3	38,288.3	44,161.0	15.2	50,441.0	14.2	56,648.0	12.2	63,156.0	11.4	70,173.0	11.0	77,504.0	10.4	126,255.0	75.5	186.0

* U. S. Census Data.

Table IV—Both the Connected Light and the Connected Power Loads Should Almost Triple by 1933

Section	Jan. 1, 1923 Light, Kw.	Jan. 1, 1923 Power, Kw.	Jan. 1, 1924 Light, Kw.	Jan. 1, 1924 Power, Kw.	Jan. 1, 1925 Light, Kw.	Jan. 1, 1925 Power, Kw.	Jan. 1, 1926 Light, Kw.	Jan. 1, 1926 Power, Kw.	Jan. 1, 1927 Light, Kw.	Jan. 1, 1927 Power, Kw.	Jan. 1, 1928 Light, Kw.	Jan. 1, 1928 Power, Kw.	Jan. 1, 1933 Light, Kw.	Jan. 1, 1933 Power, Kw.	From Jan. 1, 1923, to Jan. 1, 1928 Total, Kw.	From Jan. 1, 1923, to Jan. 1, 1928 Per Cent	From Jan. 1, 1923, to Jan. 1, 1933 Total, Kw.	From Jan. 1, 1923, to Jan. 1, 1933 Per Cent
New England	1,090,000	2,260,000	1,200,000	2,555,000	1,318,000	2,862,000	1,446,000	3,160,000	1,580,000	3,415,000	1,720,000	3,680,000	2,515,000	5,100,000	2,050,000	61.3	4,265,000	127.3
Middle Atlantic	2,540,000	5,110,000	2,910,000	5,995,000	3,360,000	6,945,000	3,780,000	7,923,000	4,200,000	9,148,000	4,695,000	10,220,000	6,890,000	15,900,000	7,265,000	95.0	15,140,000	197.5
South Atlantic	1,314,000	2,826,000	1,455,000	3,122,000	1,599,000	3,460,000	1,750,000	3,720,000	1,900,000	4,002,000	2,033,000	4,280,000	3,010,000	6,335,000	2,173,000	52.4	5,205,000	125.7
E. No. Central	3,335,000	5,365,000	3,860,000	6,070,000	4,475,000	6,975,000	4,970,000	7,750,000	5,450,000	8,600,000	5,950,000	9,550,000	8,680,000	15,700,000	6,800,000	78.0	15,680,000	180.0
W. No. Central	1,480,000	1,620,000	1,632,000	1,820,000	1,792,000	2,048,000	1,970,000	2,307,000	2,160,000	2,600,000	2,340,000	2,920,000	3,500,000	4,550,000	2,160,000	69.7	4,950,000	160.0
E. So. Central	502,000	711,000	565,000	754,000	635,000	798,000	681,000	844,000	732,000	888,000	783,000	936,000	1,098,000	1,222,000	506,000	41.6	1,107,000	91.3
W. So. Central	583,000	760,000	626,000	821,000	681,000	863,000	722,000	907,000	766,000	950,000	806,000	1,016,000	1,030,000	1,395,000	479,000	35.7	1,082,000	80.6
Mountain	195,000	667,000	214,000	755,000	242,000	813,000	273,000	870,000	303,000	960,000	330,000	1,026,000	507,000	1,440,000	494,000	57.0	1,085,000	114.0
Pacific	594,000	1,136,000	648,000	1,250,000	711,000	1,394,000	780,000	1,560,000	854,000	1,723,000	933,000	1,916,000	1,533,000	3,175,000	1,119,000	64.7	2,978,000	172.0
United States	11,633,000	20,455,000	13,110,000	23,142,000	14,813,000	26,158,000	16,372,000	29,041,000	17,945,000	32,286,000	19,590,000	35,544,000	28,763,000	54,817,000	23,046,000	72.0	51,492,000	160.0

Table V—Value of Estimated Additions and Extensions to Central Station Hydro-Electric Generating Plants

Based on unit cost of $150 per kilowatt; mechanical and electrical machinery, 15 per cent; miscellaneous, 85 per cent; labor included.

Section	1924 Machinery	1924 Miscellaneous	1924 Total	1925 Machinery	1925 Miscellaneous	1925 Total	1926 Machinery	1926 Miscellaneous	1926 Total	From 1922 Through 1927 (Five Years) Machinery	From 1922 Through 1927 (Five Years) Miscellaneous	From 1922 Through 1927 (Five Years) Total	From 1922 Through 1932 (Ten Years) Machinery	From 1922 Through 1932 (Ten Years) Miscellaneous	From 1922 Through 1932 (Ten Years) Total
New England	$651,000	$3,684,000	$4,335,000	$382,500	$2,167,500	$2,550,000	$669,000	$3,796,000	$4,465,000	$2,373,000	$13,442,000	$15,815,000	$2,943,000	$16,672,000	$19,615,000
Middle Atlantic	4,517,000	25,573,000	30,090,000	2,620,000	14,820,000	17,440,000	3,250,000	18,430,000	21,680,000	14,973,000	84,797,000	99,770,000	23,323,000	132,147,000	155,470,000
South Atlantic	1,912,000	10,838,000	12,750,000	2,048,000	11,592,000	13,640,000	2,160,000	12,240,000	14,400,000	10,777,000	61,173,000	71,950,000	25,497,000	144,453,000	169,950,000
E. No. Central	306,000	1,734,000	2,040,000	613,000	3,467,000	4,080,000	650,000	3,680,000	4,330,000	2,773,000	15,722,000	18,495,000	6,618,000	37,497,000	44,115,000
W. No. Central	574,000	3,251,000	3,825,000	498,000	2,822,000	3,320,000	535,000	3,035,000	3,570,000	2,624,000	14,861,000	17,485,000	5,556,000	31,479,000	37,035,000
E. So. Central	574,000	3,251,000	3,825,000	617,500	3,502,500	4,120,000	688,000	3,897,000	4,585,000	4,336,000	24,554,000	28,890,000	8,424,000	47,766,000	56,190,000
W. So. Central	229,000	1,301,000	1,530,000	0	0	0	0	0	0	913,000	5,237,000	6,150,000	923,000	5,227,000	6,150,000
Mountain	478,000	2,710,000	3,188,000	1,643,000	9,317,000	10,960,000	2,250,000	12,750,000	15,000,000	8,138,000	46,217,000	54,355,000	19,118,000	108,337,000	127,455,000
Pacific	4,210,000	23,840,000	28,050,000	3,825,000	21,675,000	25,500,000	3,825,000	21,675,000	25,500,000	19,100,000	108,230,000	127,330,000	48,620,000	275,500,000	324,120,000
United States	$13,451,000	$76,182,000	$89,633,000	$12,247,000	$69,363,000	$81,610,000	$14,027,000	$79,503,000	$93,530,000	$66,007,000	$374,233,000	$440,240,000	$141,022,000	$799,078,000	$940,100,000

Table VI—Estimated Growth in Rating of Generators Installed in Central-Station Steam-Electric Generating Plants

Section	Jan. 1, 1903, Kva.	Jan. 1, 1908, Kva.	Jan. 1, 1913, Kva.	Jan. 1, 1918, Kva.	Jan. 1, 1923, Kva.	Jan. 1, 1924, Kva.	Jan. 1, 1925, Kva.	Jan. 1, 1926, Kva.	Jan. 1, 1927, Kva.	Jan. 1, 1928, Kva.	Jan. 1, 1933, Kva.	Inc. from Jan. 1, 1923, to Jan. 1, 1928 (Five Years), Kva.	Inc. from Jan. 1, 1923, to Jan. 1, 1933 (Ten Years), Kva.
New England	150,600	247,200	459,500	633,000	1,268,000	1,472,000	1,690,000	1,910,000	2,095,000	2,329,000	3,579,000	1,061,000	2,311,000
Middle Atlantic	327,000	667,000	1,171,000	2,138,000	3,465,000	4,122,000	4,685,000	5,308,000	6,098,000	6,838,000	10,991,000	3,373,000	7,526,000
South Atlantic	61,100	130,600	234,000	434,000	1,385,000	1,504,000	1,699,000	1,842,000	1,993,000	2,139,000	3,199,000	754,000	1,814,000
E. No. Central	312,600	586,000	1,241,000	2,192,000	4,277,000	4,971,000	5,835,000	6,548,000	7,289,000	8,103,000	13,002,000	3,826,000	8,725,000
W. No. Central	104,300	232,700	411,800	581,000	1,279,000	1,455,000	1,643,000	1,866,000	2,109,000	2,362,000	3,770,000	1,083,000	2,491,000
E. So. Central	48,700	89,200	154,900	178,000	350,000	391,000	434,000	459,000	483,000	505,000	780,000	155,000	430,000
W. So. Central	52,500	108,600	190,300	295,000	732,000	784,000	828,000	872,000	923,000	953,000	1,289,000	221,000	557,000
Mountain	34,800	74,300	86,000	128,000	217,000	240,000	323,000	340,000	365,000	385,000	497,000	168,000	280,000
Pacific	52,700	155,000	386,000	111,000	513,000	566,000	591,000	671,000	751,000	843,000	1,471,000	330,000	958,000
United States	1,144,300	2,290,600	4,334,500	6,690,000	13,486,000	15,505,000	17,728,000	19,816,000	22,106,000	24,457,000	38,578,000	10,971,000	25,092,000

period of doubling operations must, of course, become a higher and higher figure. But the indications are that the field for the use of electrical energy will still be far from the saturation point ten years from today.

Almost Half a Million Circuit-Miles of Service Lines

The data contained in Tables IX and X on the circuit-miles of transmission and distribution lines give this information to the industry for the first time. There are almost 500,000 circuit-miles of transmission and distribution lines in the country at the present time, or sufficient to encircle the earth twenty times. By 1933 the transmission and distribution systems of the country should total about 900,000 miles, a distance equivalent to almost four times the distance from the earth to the moon.

Price of Electrical Energy Has Decreased 5.1 per Cent Since 1914

Considering the financial growth of the electric light and power industry for the next five-year and ten-year periods, figures are reached which fairly stagger the senses of comprehension. The employment of electrical energy as a source of light and heat and its happy contribution to the lightening of manual labor have made it indispensable to the human race as it is represented in the United States. The American people have become so used to paying ever-increasing prices for commodities which are essential to their wellbeing and comfort that it seems almost inconceivable that the price per unit of one of the greatest servants of mankind should have actually decreased in the past ten years.

Data collected by the Department of Labor indicates that the price of electricity to the consumer in this country decreased 5.1 per cent during the period from December, 1914, to September, 1923. In this period the price of food increased 49.3 per cent and that of clothing 76.5 per cent. Is it any wonder that it is estimated that during the future ten-year period covered by the ELECTRICAL WORLD investigation the people of this country will spend almost twenty billion dollars for electric service in their homes, on the farms and in the mines and factories? Outstanding financial figures of the present day, such as those on the foreign debt, tax reduction, soldiers' bonus and interest on the public debt, shrink into the background when the sum which the American people will gladly pay for electrical energy appears on the horizon.

Central-station gross revenue from the sale of energy should reach the annual total of $1,825,000,000 in 1927 and $2,728,000,000 in 1932. The accumulated total for the five-year period is $7,571,850,000 and for the ten-year period $19,255,000,000. The gross revenue for 1923 of $1,207,350,000, based upon the companies' reports, is under that estimated by the ELECTRICAL WORLD for the same period as given elsewhere in this issue. As pointed out before, such discrepancies indicate that the estimates made by the reporting companies of their growth were conservative and that the data contained in the accompanying tables must be considered as picturing the minimum expected increase of the industry and not in any way as a dream improbable of fulfillment. It must be remembered that these figures represent the aggregate gross income of all the operating companies and that they not only picture the amount paid by the ultimate consumer for power, but also include the sums received by central stations for energy sold to other distributing companies

Table VII—Estimated Growth in Rating of Generators Installed in Central-Station Hydro-Electric Plants

Section	Jan. 1, 1903, Kva.	Jan. 1, 1908, Kva.	Jan. 1, 1913, Kva.	Jan. 1, 1918, Kva.	Jan. 1, 1923, Kva.	Jan. 1, 1924, Kva.	Jan. 1, 1925, Kva.	Jan. 1, 1926, Kva.	Jan. 1, 1927, Kva.	Jan. 1, 1928, Kva.	Jan. 1, 1933, Kva.	Inc. from Jan. 1, 1923, to Jan. 1, 1928, (Five Years), Kva.	Inc. from Jan. 1, 1923, to Jan. 1, 1933, (Ten Years), Kva.
New England	51,400	113,800	183,000	487,500	667,000	696,000	730,000	750,000	785,000	791,000	821,000	124,000	154,000
Middle Atlantic	115,500	290,000	552,000	822,500	935,000	1,015,000	1,251,000	1,388,000	1,508,000	1,668,000	2,105,000	733,000	1,170,000
South Atlantic	16,900	113,400	283,000	486,000	1,145,000	1,290,000	1,390,000	1,497,000	1,610,000	1,710,000	2,480,000	565,000	1,335,000
E. No. Central	32,400	114,000	229,000	418,000	743,000	770,000	786,000	818,000	852,000	888,000	1,089,000	145,000	346,000
W. No. Central	10,700	73,300	93,200	390,000	481,000	504,000	534,000	560,000	588,000	618,000	772,000	137,000	291,000
E. So. Central	500	7,100	32,600	279,000	332,000	422,000	452,000	484,000	519,000	558,000	773,000	226,000	441,000
W. So. Central	1,200	2,600	7,300	7,000	20,000	26,000	38,000	38,000	38,000	68,000	68,000	48,000	48,000
Mountain	47,700	114,700	240,000	537,500	898,000	1,003,000	1,028,000	1,114,000	1,234,000	1,324,000	1,897,000	426,000	999,000
Pacific	83,300	267,000	462,000	1,092,000	1,517,000	1,664,000	1,884,000	2,084,000	2,284,000	2,517,000	4,059,000	1,000,000	2,542,000
United States	359,600	1,095,900	2,082,100	4,519,500	6,738,000	7,390,000	8,093,000	8,733,000	9,418,000	10,142,000	14,046,000	3,404,000	7,326,000

Table VIII—Value of Estimated Additions and Extensions to Central-Station

(Based on unit cost of $118 per kilowatt; boiler house and equipment, 42.6 per cent; turbine house and generating equipment,

Section	1924				1925				From 1923 to 1927, Both	
	Boiler House and Equipment	Turbine House and Generating Equipment	Feeder Equipment	Total Value of Additions and Extensions	Boiler House and Equipment	Turbine House and Generating Equipment	Feeder Equipment	Total Value of Additions and Extensions	Boiler House and Equipment	Turbine House and Generating Equipment
New England	$9,325,000	$10,670,000	$1,870,400	$21,865,400	$9,400,000	$10,724,000	$1,942,000	$22,066,000	$45,415,000	$51,923,000
Middle Atlantic	24,089,000	27,400,000	4,979,900	56,468,900	26,630,000	30,458,000	5,500,000	69,588,000	144,369,000	165,143,000
South Atlantic	8,325,000	9,500,000	1,733,500	19,558,500	6,110,000	6,966,000	1,267,000	14,343,000	32,110.000	36,855,000
E. No. Central	36,900,000	42,127,000	7,632,200	86,659,200	30,420,000	34,804,000	6,290,000	71,514,000	163,250,000	186,686,000
W. No. Central	8,023,000	9,160,000	1,673,400	18,856,400	9,520,000	10,879,000	1,968,000	22,367,000	46,243,000	52,810,000
E. So. Central	1,834,000	2,095,000	383,900	4,312,900	1,076,000	1,230,000	222,000	2,528,000	6,636,000	7,575,000
W. So. Central	1,880,000	2,145,000	388,200	4,413,200	1,880,000	2,145,000	388,000	4,413,000	9,420,000	10,798,000
Mountain	3,540,000	4,045,000	739,900	8,324,900	725,000	830,000	150,000	1,705,000	7,125,000	8,144,000
Pacific	1,068,000	1,220,000	219,500	2,507,500	3,410,000	3,908,000	706,000	8,024,000	14,073,000	16,110,000
United States	$94,984,000	$108,362,000	$19,620,900	$222,966,900	$89,171,000	$101,944,000	$18,433,000	$209,548,000	$468,641,000	$536,044,000

Table IX—Estimated Present Length and Future Growth of Central-Station Transmission Systems

(All lengths in circuit miles)

Section	Jan. 1, 1923	Jan. 1, 1924	Jan. 1, 1925	Jan. 1, 1926	Jan. 1, 1927	Jan. 1, 1928	Jan. 1, 1933	Per Cent Increase 1923-1928 (Five Years)	Per Cent Increase 1923-1933 (Ten Years)
New England	6,610	7,000	7,590	7,970	8,500	8,950	10,920	35.5	65.4
Middle Atlantic	12,740	14,930	16,380	17,720	19,500	21,220	31,650	66.7	147.0
South Atlantic	8,290	9,660	10,680	11,470	12,260	13,040	16,500	57.5	99.0
E. No. Central	18,760	20,300	21,820	23,500	25,100	27,900	37,250	48.7	98.8
W. No. Central	10,300	11,130	12,030	13,070	13,920	14,520	17,930	41.0	73.0
E. So. Central	2,600	2,900	3,280	3,680	3,900	4,080	4,900	57.0	88.5
W. So. Central	4,160	4,640	5,080	5,460	5,760	6,030	7,280	45.0	75.2
Mountain	10,900	12,000	12,530	12,980	13,400	13,950	16,050	28.0	47.2
Pacific	11,930	12,320	12,880	13,320	13,780	14,350	16,500	20.3	38.3
United States	86,290	94,880	102,270	109,170	116,120	124,040	158,980	....	.....

for resale and which is again reported by these distributing companies as a part of their gross revenue. The figures are, therefore, not directly comparable with the data on energy generated as given in Table III.

VALUE OF CENTRAL-STATION ADDITIONS AND EXTENSIONS

In arriving at the probable amounts which the central stations will need for additions and extensions to their generation, transmission and distribution systems during the next ten years careful study has been made of basic unit costs. Estimates were obtained from several authorities both as to the unit costs and as to the distribution of these costs among the various contributing items. The basic values given in the accompanying tables are the average of the estimates obtained.

It is estimated that the industry will spend a total of $1,541,831,000 during the five-year period from Jan. 1, 1923, to Jan. 1, 1928, for extensions and addi-

Table X—Estimated Present Length and Future Growth of Central-Station Distribution Systems

(All lengths in circuit miles)

Section	Jan. 1, 1923	Jan. 1, 1924	Jan. 1, 1925	Jan. 1, 1926	Jan. 1, 1927	Jan. 1, 1928	Jan. 1, 1933	Per Cent Increase 1923-1928 (Five Years)	Per Cent Increase 1923-1933 (Ten Years)
New England	38,200	40,740	43,350	45,900	47,400	49,750	59,600	30.3	56.2
Middle Atlantic	101,700	114,000	129,200	146,300	164,000	182,000	300,000	79.1	195.0
South Atlantic	31,400	33,150	35,000	37,000	39,640	42,170	58,100	34.3	85.1
E. No. Central	105,200	112,300	119,300	127,200	135,300	143,000	196,000	35.2	85.2
W. No. Central	16,720	17,880	19,220	20,340	21,680	22,980	30,500	37.4	82.4
E. So. Central	6,820	7,290	7,730	8,180	8,640	9,130	11,730	34.0	72.0
W. So. Central	8,760	9,140	9,800	10,400	10,980	11,580	15,040	32.2	71.7
Mountain	6,560	6,880	7,370	7,870	8,370	8,850	11,220	34.8	71.2
Pacific	39,420	42,400	45,700	48,800	52,300	55,500	73,250	40.8	86.0
United States	354,780	383,780	416,670	451,990	488,310	524,960	755,440	48.0	112.8

Table XI—Value of Estimated Additions and Extensions to Central-Station

Based on total cost of $4,000 per mile; poles, cross-arms, guys, etc., 25 per cent; wire, insulators and miscellaneous, 55 per

Section	1924				1925				From 1923 to 1927, Inclusive (Five		
	Poles, Cross-arms, Guys, etc.	Wire, Insulators and Miscellaneous	Labor and Supervision	Total	Poles, Cross-arms, Guys, etc.	Wire, Insulators, and Miscellaneous	Labor and Supervision	Total	Poles, Cross-arms, Guys, etc.	Wire, Insulators and Miscellaneous	Labor and Supervision
New England	$2,610,000	$5,742,000	$2,088,000	$10,440,000	$2,550,000	$7,610,000	$2,040,000	$10,200,000	$11,550,000	$25,410,000	$9,240,000
Middle Atlantic	15,200,000	33,440,000	12,160,000	60,800,000	17,100,000	37,620,000	13,680,000	68,400,000	80,300,000	176,660,000	64,240,000
South Atlantic	1,850,000	4,070,000	1,480,000	7,400,000	2,000,000	4,400,000	1,600,000	8,000,000	10,770,000	23,694,000	8,616,000
E. No. Central	7,000,000	15,400,000	5,600,000	28,000,000	7,900,000	17,380,000	6,320,000	31,600,000	37,800,000	83,160,000	30,240,000
W. No. Central	1,340,000	2,948,000	1,072,000	5,360,000	1,120,000	2,464,000	896,000	4,480,000	6,260,000	13,772,000	5,008,000
E. So. Central	440,000	968,000	352,000	1,760,000	450,000	990,000	360,000	1,800,000	2,310,000	5,082,000	1,848,000
W. So. Central	660,000	1,452,000	528,000	2,640,000	600,000	1,320,000	480,000	2,400,000	2,820,000	6,204,000	2,256,000
Mountain	490,000	1,078,000	392,000	1,960,000	500,000	1,100,000	400,000	2,000,000	2,290,000	5,038,000	1,832,000
Pacific	3,300,000	7,260,000	2,640,000	13,200,000	3,100,000	6,820,000	2,480,000	12,400,000	16,080,000	35,360,000	12,880,000
United States	$32,890,000	$72,358,000	$26,312,000	$131,560,000	$35,320,000	$79,704,000	$26,256,000	$141,280,000	$170,180,000	$374,380,000	$136,160,000

Steam-Electric Generating Plants

48.6 per cent; miscellaneous, 8.8 per cent; labor included.)

Inclusive (Five Years)		From 1923 to 1932, Both Inclusive (Ten Years)			
Feeder Equipment	Total Value of Additions and Extensions	Boiler House and Equipment	Turbine House and Generating Equipment	Feeder Equipment	Total Value of Additions and Extensions
$9,340,400	$106,678,400	$98,715,000	$113,008,000	$20,330,400	$232,053,400
29,799,900	339,311,900	321,669,000	366,694,000	66,494,900	754,857,900
6,661,500	75,626,500	77,440,000	88,493,000	16,011,500	181,944,500
33,812,200	383,748,200	372,650,000	425,485,000	76,982,200	875,117,200
9,571,400	108,624,400	106,193,000	121,663,000	21,991,400	249,847,400
1,376,000	15,587,000	18,356,000	21,010,000	3,803,000	43,169,000
1,948,200	22,166,200	23,770,000	27,189,000	4,908,200	55,867,200
1,480,900	16,749,900	11,910,000	13,602,000	2,470,900	27,982,900
2,915,500	33,098,500	41,253,000	47,312,000	8,525,500	97,090,500
$96,906,000	$1,101,591,000	$1,071,956,000	$1,224,456,000	$221,518,000	$2,517,930,000

tions to steam and hydro generating plants, this figure including the cost of labor. Steam-electric plants will call for $1,101,591,000 during this period (see Table VIII), assuming a unit cost of $118 per kilowatt, including labor. This is an average expenditure of approximately $220,000,000 per year. Of this five-year total, $468,641,000, or 42.6 per cent, will be needed for boiler houses and boiler-house equipment; $536,044,000, or 48.6 per cent, for turbine-house and generator equipment, and $96,906,000, or 8.8 per cent, for feeder equipment, each item including cost of installation. It is also estimated that more than two and a half billion dollars will be required for additions to steam generating plants by 1933.

Unit costs in the construction of hydro-electric plants will vary in accordance with local topographic and geological conditions, but for the country as a whole a unit figure of $150 per kilowatt has been assumed, which includes labor. It is estimated that $440,240,000 will be required during the period from Jan. 1, 1923, to Jan. 1, 1928, for extensions and additions to the hydro-electric systems of the country and $940,100,000 by 1933 (see Table V). This is an average of $94,000,000 per year. Of these figures, 15 per cent is for mechanical and electrical machinery and cost of installing it. A little over one-third of these expenditures for new hydro-electric systems will be accounted for by the three Pacific States.

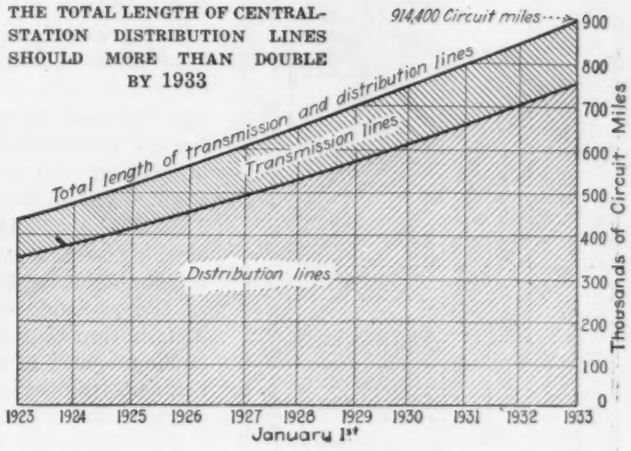
To provide means for conveying the electrical energy from the central station to the ultimate consumer the industry will require $1,240,000,000 by 1928 and

Distribution Systems

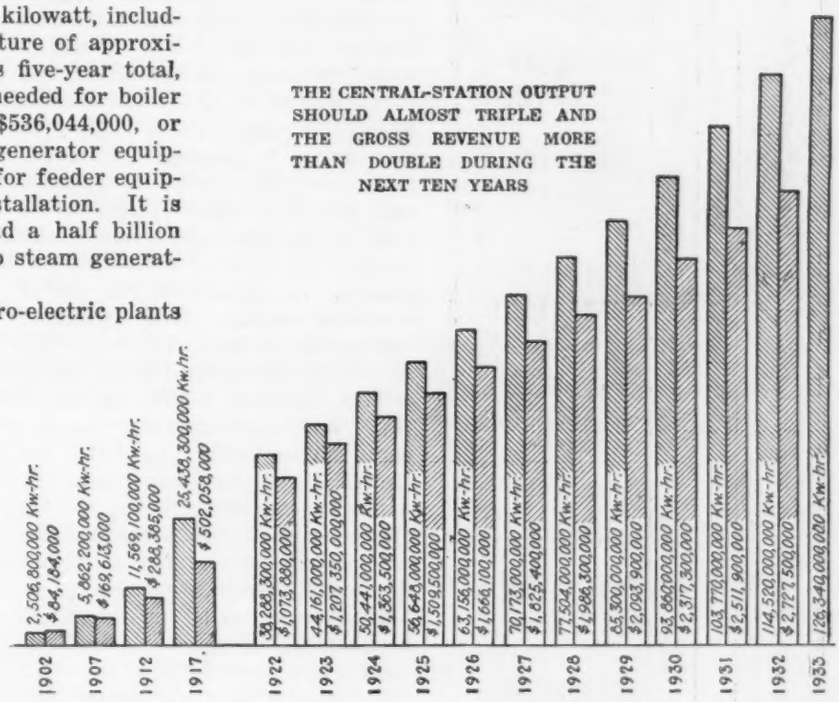
cent; labor and supervision, 20 per cent.

Years)	From 1923 to 1932 Inclusive (Ten Years)			
Total	Poles, Cross-arms, Guys, etc.	Wire, Insulators, and Miscellaneous	Labor and Supervision	Total
$46,200,000	$21,400,000	$47,080,000	$17,120,000	$85,600,000
321,200,000	198,300,000	436,260,000	158,640,000	793,200,000
43,080,000	26,700,000	58,740,000	21,360,000	106,800,000
151,200,000	90,800,000	199,760,000	72,640,000	363,200,000
25,040,000	13,780,000	30,316,000	11,024,000	55,120,000
9,240,000	4,910,000	10,802,000	3,928,000	19,640,000
11,280,000	6,280,000	13,816,000	5,024,000	25,120,000
9,160,000	4,660,000	10,252,000	3,728,000	18,640,000
64,320,000	33,830,000	74,410,000	27,080,000	135,320,000
$680,720,000	$400,660,000	$881,436,000	$320,544,000	$1,602,640,000

THE TOTAL LENGTH OF CENTRAL-STATION DISTRIBUTION LINES SHOULD MORE THAN DOUBLE BY 1933



THE CENTRAL-STATION OUTPUT SHOULD ALMOST TRIPLE AND THE GROSS REVENUE MORE THAN DOUBLE DURING THE NEXT TEN YEARS



THE GENERATOR RATING OF THE CENTRAL STATION WILL INCREASE 32,418,000 KVA. DURING THE NEXT TEN-YEAR PERIOD

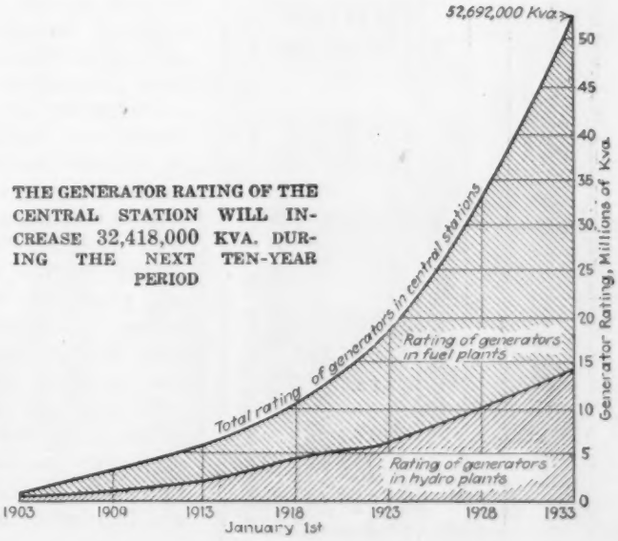


Table XII—Value of Estimated Additions and Extensions to Central-Station Transmission Systems

Based on total cost of $15,000 per mile; material, 73 per cent; labor and supervision, 25 per cent; right-of-way, 2 per cent.

Section	1924				1925				From 1923 to 1927, Inclusive (Five Years)				From 1923 to 1932, Inclusive (Ten Years)			
	Material	Labor and Supervision	Right-of-Way	Total	Material	Labor and Supervision	Right-of-Way	Total	Material	Labor and Supervision	Right-of-Way	Total	Material	Labor and Supervision	Right-of-Way	Total
New England	$6,460,000	$2,210,000	$180,000	$8,850,000	$4,160,000	$1,425,000	$115,000	$5,700,000	$25,650,000	$8,780,000	$700,000	$35,130,000	$47,158,000	$16,150,000	$1,292,000	$64,600,000
Middle Atlantic	15,880,000	5,440,000	430,000	21,750,000	14,675,000	5,023,000	402,000	20,100,000	92,855,000	31,800,000	2,545,000	127,200,000	207,320,000	71,000,000	5,680,000	284,000,000
South Atlantic	11,180,000	3,820,000	300,000	15,300,000	8,653,000	2,960,000	237,000	11,850,000	52,000,000	17,820,000	1,430,000	71,250,000	90,000,000	30,800,000	2,400,000	123,200,000
E. No. Central	16,644,000	5,700,000	456,000	22,800,000	18,400,000	6,300,000	500,000	25,200,000	100,000,000	34,260,000	2,740,000	137,000,000	202,500,000	69,300,000	5,500,000	277,300,000
W. No. Central	9,850,000	3,380,000	270,000	13,500,000	11,388,000	3,900,000	312,000	15,600,000	46,164,000	15,820,000	1,266,000	63,250,000	83,600,000	28,620,000	2,280,000	114,500,000
E. So. Central	4,160,000	1,425,000	115,000	5,700,000	4,380,000	1,500,000	120,000	6,000,000	16,206,000	5,550,000	444,000	22,200,000	25,200,000	8,610,000	690,000	34,500,000
W. So. Central	4,820,000	1,650,000	130,000	6,600,000	4,160,000	1,426,000	114,000	5,700,000	20,440,000	7,000,000	560,000	28,000,000	34,200,000	11,700,000	900,000	46,800,000
Mountain	5,800,000	1,990,000	160,000	7,950,000	4,925,000	1,690,000	135,000	6,750,000	33,523,000	11,460,000	817,000	45,800,000	56,383,000	19,320,000	1,547,000	77,250,000
Pacific	6,130,000	2,100,000	170,000	8,400,000	4,818,000	1,650,000	132,000	6,600,000	26,500,000	9,077,000	723,000	36,300,000	50,078,000	17,150,000	1,372,000	68,600,000
United States	$80,924,000	$27,715,000	$2,211,000	$110,850,000	$75,559,000	$25,874,000	$2,067,000	$103,500,000	$413,338,000	$141,567,000	$11,225,000	$566,130,000	$796,439,000	$272,650,000	$21,661,000	$1,090,750,000

$2,700,000,000 by 1933 for additional transmission and distribution systems, including material, labor and right-of-way. These figures do not include the amounts needed for repairs and depreciation of existing systems, which will undoubtedly assume large proportions. Tables XI and XII give the details of the expected expenditures. The Middle Atlantic States easily lead in the probable extensions to the distribution systems, owing mainly to the presence of many large cities, necessitating extensive residential distribution systems.

Turning to the realm of speculation, some very interesting conclusions may be reached as regards the amount of money which central-station customers will probably spend for electrical appliances and supplies during the next decade. Energy of any sort is useless to man unless he possesses the apparatus for this energy to operate, and almost without exception the cost of the mechanism materially exceeds the cost of producing the energy. So it is with the use of electrical energy. It is estimated that central-station customers will spend approximately twelve billion dollars from Jan. 1, 1923, to Jan. 1, 1928, and approximately twenty-eight billion dollars by 1933, for electrical appliances and supplies. A most encouraging fact to the industry is that when a family once becomes a central-station customer it always possesses certain potentialities as a purchaser of electrical appliances. Therefore, in estimating the total probable amount which the central-station customers will spend for electrical appliances and supplies, old customers must be considered as well as new customers, although each has a different but distinct purchasing power. The figures given above are based on the assumption that the cost of wiring houses and factories and the cost of motors, lamps and appliances needed by new central-station customers will aggregate $125 per kilowatt of added installed generating rating, with a diversity factor of six, giving the capital required to supply new customers' needs at $750 per generator kilowatt. It is also assumed that old customers will purchase appliances to the value of $25 per year per kilowatt rating of the central stations, the total sales to this class of purchasers increasing each year.

Table XIII—Value of Estimated Purchases of Electrical Appliances and Supplies by Central-Station Customers

(Based on assumption that the cost of wiring houses and factories and the cost of motors, lamps and appliances needed by new central-station customers will aggregate $125 per kilowatt of added installed generator rating, with a diversity factor of six, giving the capital required to supply new customers' needs as $750 per generator kilowatt. It is also assumed that old customers will purchase apparatus to the value of $25 per year per kilowatt rating of central stations.)

Section	1924			1925			From 1923 to 1927, Both Inclusive (Five Years)			From 1923 to 1932, Both Inclusive (Ten Years)		
	Value of Purchases by Customers Added During Year	Value of Purchases by Old Customers	Total Value of Purchases During Year	Value of Purchases by Customers Added During Year	Value of Purchases by Old Customers	Total Value of Purchases During Year	Value of Purchases by Customers Added During Five Years	Value of Purchases by Old Customers	Total Purchases During Five Years	Value of Purchases by Customers Added During Ten Years	Value of Purchases by Old Customers	Total of Purchases During Ten Years
New England	$160,800,000	$46,100,000	$206,900,000	$153,200,000	$51,400,000	$204,600,000	$757,000,000	$256,300,000	$1,013,300,000	$1,576,000,000	$640,600,000	$2,216,600,000
Middle Atlantic	511,500,000	109,600,000	621,100,000	485,500,000	126,600,000	612,100,000	2,668,000,000	636,100,000	3,304,100,000	5,600,000,000	1,778,600,000	7,378,600,000
South Atlantic	188,400,000	58,700,000	247,100,000	159,700,000	65,000,000	224,700,000	842,000,000	323,000,000	1,165,000,000	2,012,000,000	829,800,000	2,841,800,000
E. No. Central	562,000,000	122,100,000	684,100,000	476,000,000	140,800,000	616,800,000	2,540,000,000	699,200,000	3,239,200,000	5,790,000,000	1,860,500,000	7,650,500,000
W. No. Central	139,200,000	41,200,000	180,400,000	159,000,000	45,700,000	204,700,000	780,000,000	231,700,000	1,011,700,000	1,778,000,000	609,400,000	2,387,400,000
E. So. Central	45,900,000	17,200,000	63,100,000	37,100,000	18,700,000	55,800,000	242,500,000	91,500,000	334,000,000	556,000,000	219,100,000	775,100,000
W. So. Central	35,800,000	17,200,000	53,000,000	28,100,000	18,400,000	46,500,000	171,900,000	91,400,000	263,300,000	386,000,000	213,500,000	599,500,000
Mountain	69,000,000	24,200,000	93,200,000	65,800,000	26,600,000	92,400,000	380,000,000	133,000,000	513,000,000	816,000,000	331,700,000	1,147,700,000
Pacific	156,500,000	47,500,000	204,000,000	179,000,000	52,700,000	231,700,000	850,000,000	266,600,000	1,116,600,000	2,240,000,000	710,500,000	2,950,500,000
United States	$1,869,100,000	$483,800,000	$2,352,900,000	$1,743,400,000	$545,900,000	$2,289,300,000	$9,231,400,000	$2,728,800,000	$11,960,200,000	$20,754,000,000	$7,193,700,000	$27,947,700,000

Central-Station Industry Reports Record Operations During 1923

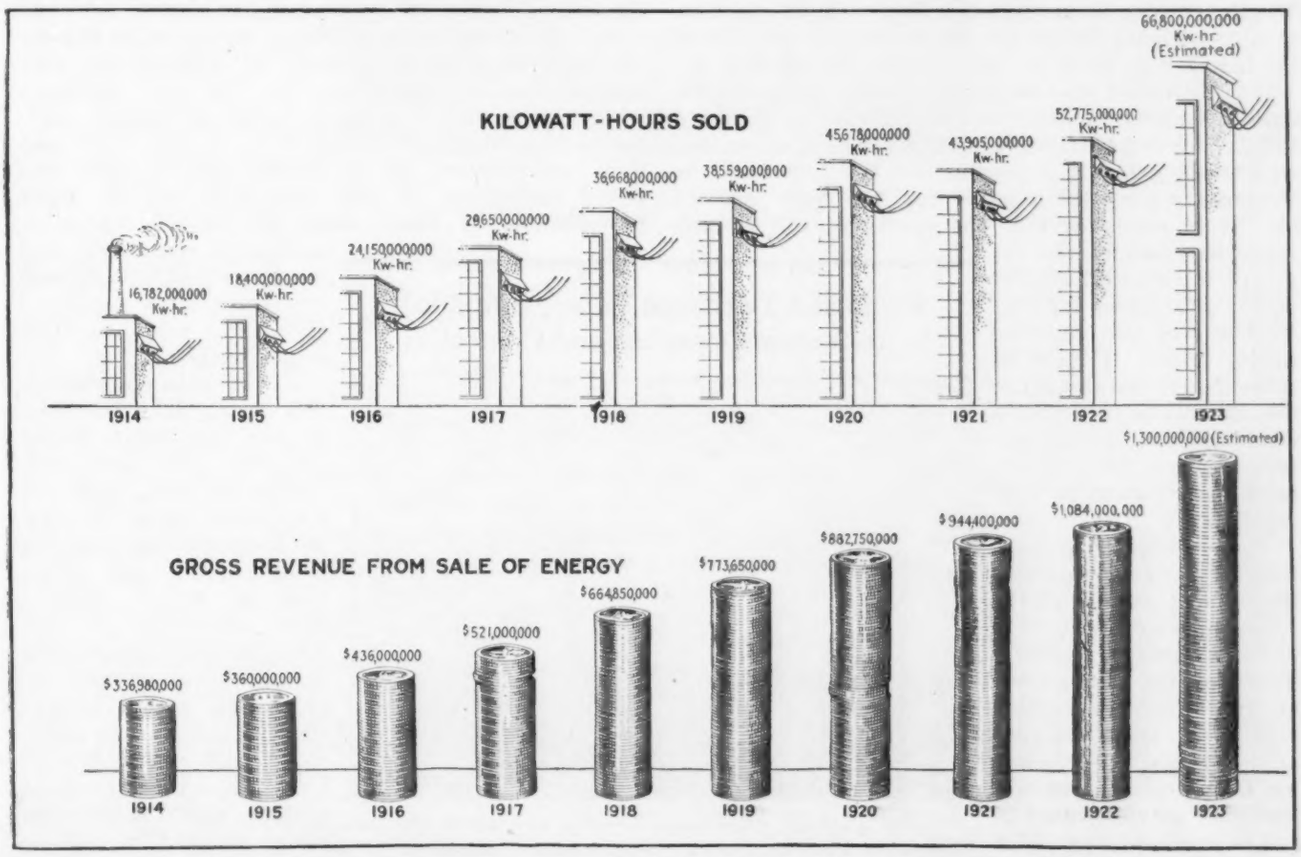
Output Increased 26.4 per Cent Over 1922—Gross Revenue for the Year Estimated at $1,300,000,000—Capital Invested Totals $5,800,000,000—Operating Ratio on the Decrease

STATISTICALLY and economically the year 1923, just closed, stands out as the greatest year in the history of the electric light and power industry. Not only did the industry report record output and revenue figures, but the increase over the previous year is by far the largest ever recorded.

Based on operations reported for the first ten months of the year, it is estimated that a total of 66,800,000,000 kw.-hr. of electrical energy was sold by the industry during 1923, which is an increase of 26.4 per cent over 1922, 52.0 per cent over 1921, the year of industrial depression, and 46.2 per cent over 1920, the peak year of post-war industrial activity. It must be remembered that this huge figure does not represent the actual amount of electrical energy consumed during 1923, but is the amount of energy actually sold by the various distributing companies, some of which was sold to other public utilities for resale and is therefore counted twice in the resulting tabulation. In other words, this output figure is the aggregate of the energy sold by the various public utilities, whether for resale or consumption.

There are four distinct figures issued relative to the energy generated and distributed by the central stations of the United States. First is the figure issued by the United States Census Bureau, which gives the amount of energy generated by the electric light and power companies of the country. This figure is issued every

THE OPERATING RATIO OF COMPANIES OPERATING STEAM-ELECTRIC GENERATING PLANTS ONLY, HAS DECREASED MATERIALLY SINCE 1920



ANNUAL REVENUE FROM THE SALE OF ELECTRICAL ENERGY HAS NEVER SUFFERED A DECREASE

INCREASE IN CENTRAL-STATION OPERATIONS FOR THE PAST FIVE YEARS AS REPORTED FROM EVERY SECTION OF THE COUNTRY

Section	1919	1920	1921	1922	1923†
KILOWATT-HOURS OUTPUT*					
United States	38,559,000,000	45,678,000,000	43,905,000,000	52,775,000,000	66,800,000,000
New England States	2,444,900,000	3,309,700,000	3,201,900,000	4,093,900,000	5,026,000,000
Atlantic States	13,944,100,000	16,363,600,000	15,879,200,000	19,204,800,000	24,638,000,000
North Central States	12,211,600,000	14,972,000,000	14,837,200,000	17,347,900,000	21,879,000,000
South Central States	2,383,400,000	2,726,800,000	2,825,500,000	3,442,500,000	4,433,000,000
Mountain and Pacific States	7,575,000,000	8,305,900,000	7,161,200,000	8,685,900,000	10,824,000,000
GROSS REVENUE FROM SALE OF ENERGY					
United States	$773,650,000	$882,750,000	$944,400,000	$1,084,000,000	$1,300,000,000
New England States	63,890,000	84,570,000	89,050,000	97,890,000	123,100,000
Atlantic States	299,960,000	312,760,000	342,970,000	399,990,000	487,600,000
North Central States	255,030,000	298,680,000	314,600,000	373,060,000	428,600,000
South Central States	53,770,000	68,050,000	77,020,000	84,370,000	105,400,000
Mountain and Pacific States	101,000,000	118,690,000	120,760,000	128,690,000	155,300,000
OPERATING AND MAINTENANCE EXPENSES					
United States	.....	$440,650,000	$459,370,000	$523,660,000	$627,700,000
New England States	.....	46,470,000	42,810,000	51,540,000	69,060,000
Atlantic States	.....	150,980,000	161,050,000	177,400,000	214,850,000
North Central States	.....	160,360,000	170,620,000	199,520,000	233,050,000
South Central States	.....	35,980,000	40,640,000	46,160,000	54,500,000
Mountain and Pacific States	.....	46,860,000	44,250,000	49,040,000	56,240,000

*Includes energy purchased for resale. †Estimated.

five years when the census is taken. Second is the figure issued by the Census Bureau giving the total amount of energy generated by electric light and power companies and electric railway companies combined. This total is also issued at five-year intervals. Third are the monthly and yearly data issued by the United States Geological Survey, which include not only the strictly electric light and power companies and electric railways, but also the output of a number of large generating plants in manufacturing establishments which sell blocks of energy to other establishments, as well as the output of the Reclamation Service plants. Fourth is the ELECTRICAL WORLD figure, quoted above, which is the aggregate of the energy sold by the various companies of the country, a portion to other public utilities for resale and a portion to ultimate consumers. The ELECTRICAL WORLD figure is, however, directly comparable with the figure for the total gross revenue of the industry as given in the following paragraph.

It is estimated that the gross revenue of the electric light and power industry totaled $1,300,000,000 during 1923, which is $226,000,000, or 19.8 per cent, above that reported in 1922. It is possible that this figure may be increased when full reports for the year are on file. It is estimated that the operating and maintenance expenses of the industry totaled $627,700,000 during 1923, which is $104,040,000 over that reported during 1922. It must be remembered that this figure does not include the amounts deducted from central-station revenue for interest, taxes, depreciation or sinking funds.

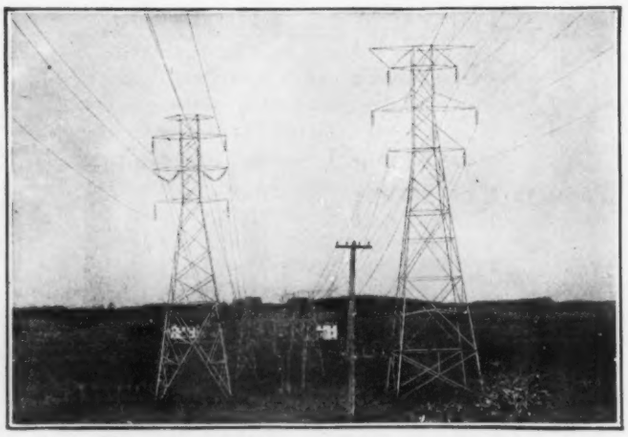
The accompanying table indicates the extent to which the various sections of the country have contributed to this stupendous growth. Every section of the country reported decreased output during 1920, the year of industrial depression, but in recent years no section has ever reported a loss in gross revenue under the previous year.

A very interesting and encouraging picture is obtained by a study of the movement of the operating ratio for the past four years. This figure, the ratio of operating expenses to gross revenue from sale of energy, has shown a decidedly downward tendency since July, 1920, which was the month of peak prices of commodities. During this peak month an operating ratio of 65.9 per cent was recorded by companies operating steam-electric generating plants. By January, 1921, eighteen months later, this average operating ratio had fallen to 45.8 per cent. During the past two years the operating ratio has followed the usual seasonal range, but it has shown a slight decrease during the past year under 1922. It is probable that the operating ratio recorded a new low point during December just passed.

A large increase of the invested capital is reported for 1923. The capital invested in the electric light and power industry on Jan. 1, 1924, is estimated at $5,800,000,000, which is an increase of $700,000,000 over that of Jan. 1, 1923. The National City Company, which keeps very close new-capital tabulations, estimates that the probable increase in the bond and note capitalization of the purely electric light and power companies for the year 1923 will be about $429,600,000, of which about $67,100,000 represents refunding operations, and the balance of $362,500,000 represents new capital which was raised through senior financing.

As indicated elsewhere in this issue, data tabulated by the ELECTRICAL WORLD indicates that the total amount of bond, note and stock financing of the companies conducting primarily electric light and power business, which includes those operating gas and street railway departments in addition to electric departments, was $744,511,400. To this must be added approximately $250,000,000 from the sale of securities made by public utility companies directly to their customers.

Radio and Telephone Principle Applied to System Operation and Control

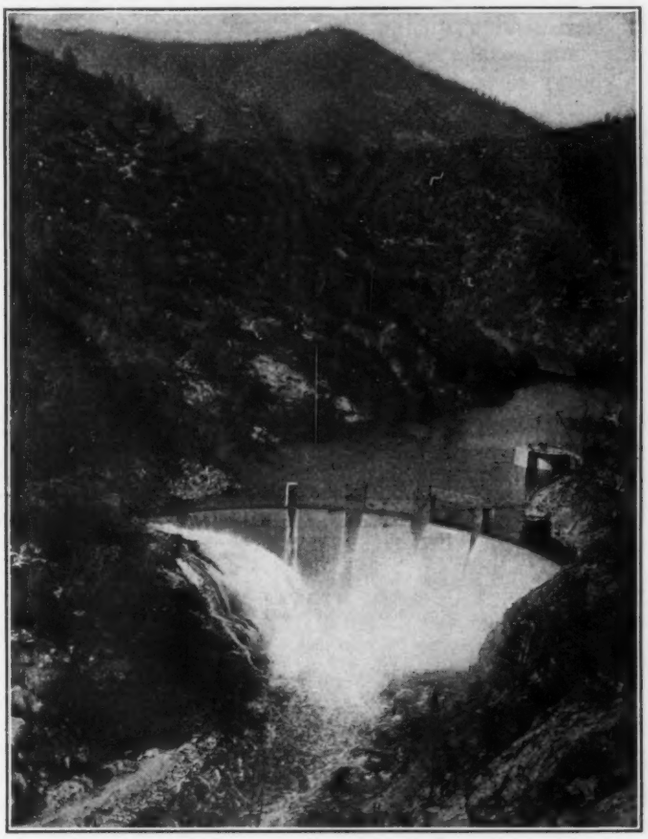


Carrier current, supervisory control and wired wireless have been used by power companies with success. The Baltimore-Holtwood line has a carrier-current installation.

Status of Hydro-Electric Construction

Twenty-nine Projects Now Being Constructed Under Licenses from the Federal Power Commission—California Leads in Number and Horsepower of Projects Now Being Developed

THE development of water power and its relation to the growth of the nation has occupied a unique position during 1923 as a subject of nation-wide discussion. The President in his annual message to Congress laid special stress upon it, governors of states have endeavored to work out plans for encouraging development, public utility commissioners from the industrial Atlantic States have met to discuss the question at the call of the Secretary of Commerce, and the subject has been to the fore at almost every engineering convention during the year. The expressions "superpower" and "interconnection" have entered into the vocabulary even of the man on the street.



SOUTHERN CALIFORNIA EDISON COMPANY DAM NO. 6 ON SAN JOAQUIN RIVER. DAM IS 137 FT. HIGH, 400 FT. LONG

The relation of water power to superpower is very definite, and it is clearly defined in the third annual report of the Federal Power Commission. "Since the interconnection of hydro plants with steam plants permits a far greater utilization of the water supply than would otherwise be possible, interconnected systems afford the condition under which water powers can be most efficiently operated. The initial cost of a hydro-electric plant, with its dams, reservoirs, canals, power houses and transmission lines, is likely to exceed considerably the cost of a steam plant of like capacity. Its operating expenses are, however, lower and it burns no fuel. It becomes economically superior to the steam plant whenever its lower operating costs more than offset its greater interest charges. Its interest charges are fixed and its total operating expenses vary but slightly whether the plant operates at partial or at full load, so that, with the total expenses practically a fixed item in any particular hydro plant, the cost per kilowatt-hour decreases as the output increases. When seasonal storage and adequate pondage are available, the hydro plant can be operated on a base load or on daily or seasonal peak load as best suits general operating conditions in the system, a situation which not only permits the most complete use of the available water supply but also affords operating flexibility and economy in the system as a whole.

"The close relation between superpower systems and water-power development and the extent to which they are interdependent may be indicated by the fact that our two greatest systems, one on the Pacific Coast and the other in the South Atlantic States, have been developed concurrently with the development of water powers, and that there are no systems based upon steam power comparable with these two in extent of territory served. Water powers will be essential factors in the creation and expansion of superpower systems not only in the West and in the South, where water power is the dominant source of electrical energy, but also in the North and East, where, on account of lesser water-power resources, dependence must continue to be placed upon steam power for the production of a large part of the energy supply. It is only a matter of time, and that not far distant, when through the natural expansion of adjacent local groups of plants and lines we should have in the eastern United States a superpower system rivaling that of the Pacific Coast."

An indication of the interest in water-power development is to be gathered from the activities during the past year of the Federal Power Commission. As shown in Table III, there were 317 active applications on file with the Federal Power Commission on Nov. 1, 1923, involving a total of 12,687,630 primary horsepower available 90 per cent of the time and an estimated ultimate installation of 22,270,000 hp. Since the organization of the commission 447 applications have been filed, involving 33,425,500 hp. ultimate installation, but 130 of these applications, involving 11,155,500 hp., have been rejected, canceled or withdrawn.

The hydro-electric projects now under actual construction under licenses from the Federal Power Commission involve a proposed ultimate installation of 2,339,010 hp., and the cost of these developments is estimated at $207,805,150. The horsepower of these projects scheduled to be put in operation in 1923 is 186,010 and in 1924, 260,780. Thirteen of the twenty-nine projects under construction are in California.

The two outstanding projects now being constructed under Federal Power Commission permits are the additional installation of the Niagara Falls Power Company at Niagara Falls, involving a total ultimate development of 601,835 hp., and the Big Creek project of the Southern California Edison Company, with a total ultimate development of 540,000 hp. The Niagara Falls Power Company put the first 70,000-hp. unit of its new installation into operation last month, and the remaining 140,000 hp. of the company's initial development will probably go into commission during the coming summer. In spite of the additional energy from this new unit, as well as the energy to be produced by the two other units of 70,000 hp. each, the demand for cheap, constant hydro-electric power from Niagara outruns the supply. Further extensions to this plant, however, cannot be made until the present restrictions on the use of the waters of the Niagara River are modified.

The Big Creek development of the Southern California Edison Company is scheduled to be completed by 1935 at a total estimated cost of $61,152,000. Another unusual development in California is that of the San

Table II — Transmission Lines Being Constructed Under Licenses Issued by the Federal Power Commission as of Nov. 1, 1923

Project No.	Estimated Cost per Mile	Schedule Date of Completion	Miles Included in License	Voltage of Line
431	$4,337	Jan. 1, 1924	4.80	66,000
429	3,625	June 1, 1924	7.50	110,000
422	2,000	Dec. 1, 1924	2.3	17,000
390	18,750	July 1, 1924	26.50	220,000

Table III—Applications Filed with Federal Power Commission as of Nov. 1, 1923

	Number	Horsepower — Primary Power (90 Per Cent of Time)	Horsepower — Estimated Ultimate Installation
Preliminary permits authorized	101	3,092,955	6,004,190
Permits canceled, expired or superseded by licenses	18	307,035	708,405
Permits outstanding	83	2,785,920	5,295,785
Licenses authorized	111	1,064,041	2,658,576
Gross total to November 1, 1923	...	20,603,080	33,425,500
Deductions, for conflicts, rejections and withdrawals	...	7,915,450	11,155,500
Net total Nov. 1, 1923	...	12,687,630	22,270,000
Total applications filed	447		
Applications rejected, canceled or withdrawn	130		
Active applications	317		

Table I—Hydro-Electric Projects Under Construction Under Licenses from the Federal Power Commission as of Nov. 1, 1923

Name of Company	Name of Stream	Proposed Ultimate Installed Hp.	Total Estimated Cost	Scheduled Date of Completion of Project	Horsepower Scheduled to Be Put in Operation 1923	1924	1925	Remarks Relative to Estimated Cost
Alabama								
City of Dothan	Choctawhatchee River	6,000	$658,000	9- 1-26	.....	.....	.....	.....
Alabama Power Co.	Coosa River	110,000	10,000,000	O.M.D.*	66,000	.....	.....	Includes 48,000 hp. of electrical apparatus only.
Houston Power Co.	Choctawhatchee River	4,800	508,871	10- 1-25	.....	.....	3,600	No transmission line included
Alabama Interstate Power Co.	Tallapoosa River	105,000	10,000,000	9- 1-26	.....	.....	.....	Includes cost of 67,000 hp. of apparatus only.
Arkansas								
Arkansas Light & Power Co.	Ouachita River	96,000	8,055,000	7- 1-36	.....	.....	40,000	.....
California								
Southern California Edison Co.	Big Creek	545,000	61,152,000	7- 1-35	.....	.....	.....	30,000 hp. in operation
Snow Mountain Water & Power Co.	South Eel River	19,730	6,665,000	1- 1-26	.....	.....	19,730	Includes 110 miles transmission line
Southern California Edison Co.	San Joaquin River	195,000	13,890,000	12-31-29	100,000	.....	.....	.....
San Joaquin Light & Power Corp.	North and West Forks of Kings River	300,000	50,970,000	1- 1-31	.....	41,000	.....	.....
El Dorado Power Co.	South Fork American River	100,000	8,922,319	12-31-28	20,000	.....	20,000	.....
Southern Sierras Power Co.	High Creek	4,000	630,000	12-31-25	.....	.....	4,000	.....
Yuba Development Co.	North Fork Yuba River	7,000	894,200	12-31-24	.....	7,000	.....	.....
Little Rock Power & Water Co.	Little Rock Creek	2,270	500,000	10- 1-24	.....	2,270	.....	Exclusive of $300,000 for irrigation works
Mount Shasta Power Corp.	Pit River	99,050	13,041,600	12-31-26	.....	.....	.....	.....
Frank M. Wilson	Willer and Camp Creeks	15	3,000	1- 1-25	.....	15	.....	$200 per hp. assumed
San Gorgonia Power Co.	San Gorgonia River	2,250	300,000	3-31-25	.....	.....	2,250	Includes 10 miles of transmission line
C. B. Johnson	Sawmill Creek	325	35,000	7- 1-26	.....	.....	.....	.....
City of Sacramento	South Fork American River	15	2,770	9- 1-24	.....	15	.....	.....
Colorado								
A. E. Humphreys	.....	10	2,000	12-31-23	10	.....	.....	.....
Idaho								
J. M. Freeman	Boulder Creek	100	5,060	12- 1-25	.....	.....	100	.....
Unity Gold Mines Co.	Elk River	480	72,000	1- 1-25	.....	480	.....	$150 per hp. assumed
Michigan								
Michigan Hydro-Electric Power Co.	St. Joseph River	2,300	454,830	1- 1-26	.....	.....	2,300	.....
Minnesota								
Pike Rapids Power Co.	Mississippi River	24,000	2,380,000	7- 1-26	.....	.....	.....	.....
Ford Motor Co.	Mississippi River	19,200	1,475,000	7- 1-25	.....	.....	19,200	Exclusive of dam owned by U. S.
New York								
Niagara Falls Power Co.	Niagara Falls	601,835	5,494,000	9- 1-24	.....	210,000	.....	Estimated cost for 210,000 hp. only, including substation and transmission line to substation
Oregon								
Portland Railway, Light & Power Co.	Oak Grove Creek	30,800	2,685,000	12-31-25	.....	.....	30,800	.....
Pennsylvania								
Clarion River Power Co.	Clarion River	42,500	6,460,000	12- 1-27	.....	.....	.....	.....
Utah								
Utah Power & Light Co.	Bear River	21,000	2,500,000	7- 1-26	.....	.....	.....	.....
Alaska								
B. A. Garber	Kanatak Creek	330	49,500	7- 1-25	.....	.....	330	.....
Totals		2,339,010	$207,805,150		186,010	260,780	142,310	

*O.M.D.—On market demand for power.

Joaquin Light & Power Corporation on Kings River, involving 300,000 hp. and an estimated cost of $50,970,000. This project is scheduled for completion in 1931.

There are four short transmission lines now being constructed under Federal Power Commission permits. These are only small sections of transmission systems, a permit being required only for such portions of the system as cross public lands.

In Table IV are listed other projects some of which will be constructed under licenses from the Federal Power Commission. This tabulation taken in conjunction with Table I is believed to include all the important hydro-electric projects now under construction in this country and Canada. The projects are fairly well distributed throughout the country, indicating widespread interest in the development of the nation's natural resources.

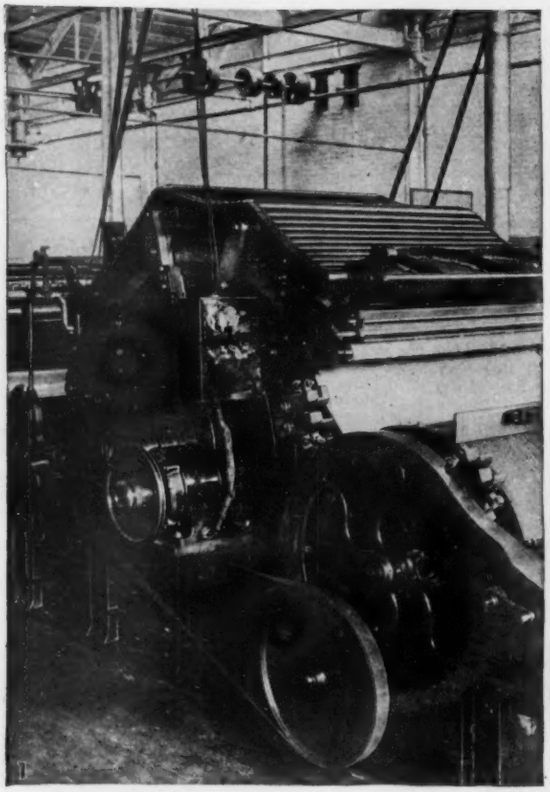
Table IV—Large Hydro-Electric Projects Under Construction in Addition to Those Indicated in Table I

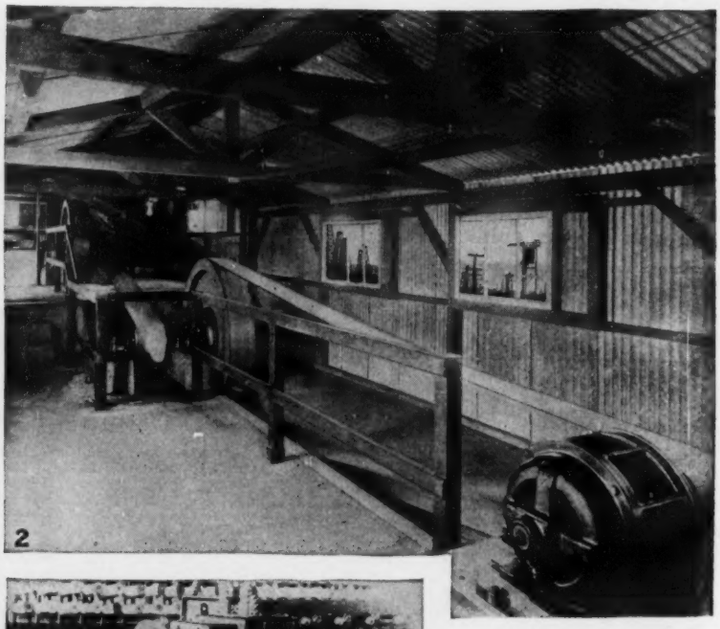
(As recorded in the "Electrical World" up to Dec. 1).

Name of Company	Plant	Initial Hp.	Ultimate Hp.	Date of Operation
Alabama				
Alabama Power Co.	Mitchell Dam	75,000	120,000	1923
Alabama Power Co.	Tallapoosa	88,000	132,000	1925
Alabama Power Co.	Cherokee Bluffs	44,000	.....	....
United States Government	Muscle Shoals	120,000	.....	1924
Arizona				
Roosevelt Dam Project	Salt River	*7,000	.....	.....
California				
Feather River Power Co.	Bean Creek	62,000	202,000	1925
Great Western Power Co.	Caribou	30,000	180,000	1924
Los Angeles Municipal System	San Francisquito	*16,000	.....	1924
Modesto-Turlock Irrigation Dist.	Don Pedro	15,000	.....	1923
Pacific Gas & Electric Co.	Pit No. 3	90,000	.....	1925
San Francisco Municipal Plant	Hetch Hetchy	100,000	100,000	1924
Sierras Power Co.	Leevening Creek	*14,000	.....	1923
Southern Sierras Power Co.	Mill Creek	3,000	.....	1924
Western States Gas & Elec. Co.	Eldorado	27,000	100,000	1924
Two generating plants	.....	37,000	.....	1924
Turlock and Modesto Irrig. Dist.	.....	36,000	.....	....
Connecticut				
Farmington River Hydro. Corp.	New Boston	7,600	.....	1925
Georgia				
Georgia Railway & Power Co.	Mathis	15,000	.....	1924
Georgia Railway & Power Co.	Tugaloo	60,000	.....	1924
Georgia Railway & Power Co.	Bull Shine	*5,000	.....	1925
Georgia Railway & Power Co.	Leeds	6,000	.....	1925
Georgia Railway & Power Co.	Burton	6,000	.....	1926
Georgia Railway & Power Co.	Tugaloo and Tallulah	30,000	.....	1926
Georgia Ry. and Pwr. Co.	Sawtooth	8,000	.....	....
Idaho				
Idaho Power Co.	Snake River	*20,000	.....	1923
†One generating plant	.....	8,700	.....	1924
Iowa				
Eastern Iowa Power Co.	Pinhook	1,800	.....	1923
Indiana				
Indiana Hydro-Electric Co.	Norway	2,500	9,000	1923
Kansas				
Empire District Electric Co.	Table Rock	60,000	.....	1925
Kentucky				
Kentucky Hydro-Electric Co.	Dix River	25,000	.....	1924
Louisville Electric Co.	Falls of Ohio	75,000	.....	1926
Maine				
† Four generating plants	.....	7,400	.....	1924
Lockwood Mills	Waterville	6,000	.....	1923
Penobscot Power Co.	Medway	6,000	.....	1923
Massachusetts				
New England	Davis Bridge	40,000	.....	1923
† One generating plant	.....	1,600	.....	1924
New England Power Co.	Vernon	4,200	.....	....
Michigan				
† Two generating plants	.....	4,300	.....	1924
Ford Motor Co.	Iron Mountain	10,000	.....	....
Minnesota				
Minnesota Light & Pwr. Co.	Jim Falls	16,000	.....	1923
Northern States Power Co.	St. Croix Falls	*9,000	.....	....
† One generating plant	.....	16,000	.....	1924
Minnesota Utilities	Kawishiwi	6,000	.....	....
Ford Motor Co.	Flat Rock	900	.....	1923
Montana				
Montana Power Co.	Mystic Falls	15,000	.....	1924
New Hampshire				
† Two generating plants	.....	9,000	.....	1924
Lake Sunapee Power Co.	Sunapee Harbor	.....	.....	....
New York				
International Paper Co.	Sherman Island	30,000	.....	1923
† Eleven generating plants	.....	42,000	.....	1924
Hudson River Reg. Bd.	Battenkill	.....	.....	.....
Moreau Mfg. Co.	Feeder Dam	7,500	.....	1924
New York State	Crescent Dam	16,000	.....	1924
New York State	Vischers Ferry	16,000	.....	1924
Power Corp. of New York	Flat Rock	4,000	.....	....
Power Corp. of New York	Roquette River	.....	.....	....
United Hudson Elect. Corp.	Sturgeon Pool	18,000	.....	1924
Watertown Municipal	Delano Falls	5,100	.....	....
North Carolina				
Blue Ridge Power Co.	Turner Shoals	10,000	.....	1924
Southern Power Co.	Mount Holly	80,000	.....	1923
Oregon				
Pacific Power & Light Co.	Hood	8,700	.....	1923
Pacific Power & Light Co.	Deschutes	40,000	40,000	1926
Portland Railway & Light Co.	Clackamas River	35,000	105,000	1924
† One generating plant	.....	1,300	.....	1924
Pennsylvania				
Pennsylvania Power & Lt. Co.	Hawley	50,000	.....	1925
Pennsylvania Public Serv. Corp.	Clarion River	25,000	260,000	1923
Pennsylvania Water & Power Co.	Holtwood	*40,000	.....	1924
South Carolina				
Southern Power Co.	Great Falls	60,000	.....	1923
Southern Power Co.	Catawba	50,000	.....	1924
† One generating plant	.....	3,125	.....	1924
Southern Power Co.	Mountain Island	90,800	.....	1923
Tennessee				
Tennessee Electric Power Co.	Great Falls	22,200	.....	1924
Utah				
Dixie Power Co.	White River	50,000	160,000	1926
Virginia				
Roanoke Rapids Power Co.	.....	3,200	.....	1924
Washington				
Seattle Municipal Plant	Skagit	40,000	70,000	1923
Washington Water & Power Co.	Oroville	*2,500	.....	1923
† Two generating plants	.....	17,000	.....	1924
Wisconsin				
Lake Superior District Power Co.	Flambeau	16,000	.....	1925
† Two generating plants	.....	3,700	.....	1924
Wisconsin Valley Elec. Co.	.....	7,500	.....	....
St. Croix Paper Co.	Grand Falls	4,500	.....	1923
Canada				
British Columbia Elec. Co.	Stave Lake	*25,000	.....	1924
Canadian Assoc. Gold Fields, Ltd.	Wendigo Falls	6,000	.....	....
Hollinger Cons. Gold Mines, Ltd.	Island Portage	24,000	.....	1924
Hydro-Electric Power Comm. of Ontario	Queenstown-Chippawa	104,000	.....	....
Hydro-Electric Power Comm. of Ontario	Queenstown-Chippawa	174,000	.....	1924
Hydro-Electric Power Comm. of Ontario	Trent River	6,600	.....	1923
Hydro-Electric Power Comm. of Ontario	Cameron Falls	*25,000	.....	1923
Newfoundland Power and Pulp Co.	Humber River	118,000	.....	1925
Northern Canada Power Co.	Des Quinze River Falls	20,000	.....	1924
Nova Scotia Power Comm.	Malay Falls	.....	.....	....
Ottawa and Hull Pwr. and Mfg. Co.	Calume Island	25,000	.....	1924
Price Bros. and Co., Ltd.	Chicoutimi	11,000	.....	1924
Quebec Development Co.	Lake St. John	320,000	.....	1924
Shawinigan Water and Pwr. Co.	La Gabelle	132,000	.....	1924
Shawinigan Water and Pwr. Co.	Shawinigan Falls	*43,000	.....	1923
Southern Canada Power Co.	Hemming Falls	33,600	.....	1924
Winnipeg Municipal	Point du Bois	24,500	.....	....

* Extensions. † Confidence requested on individual names of companies.

Some Outstanding Applications in Industry Were Made



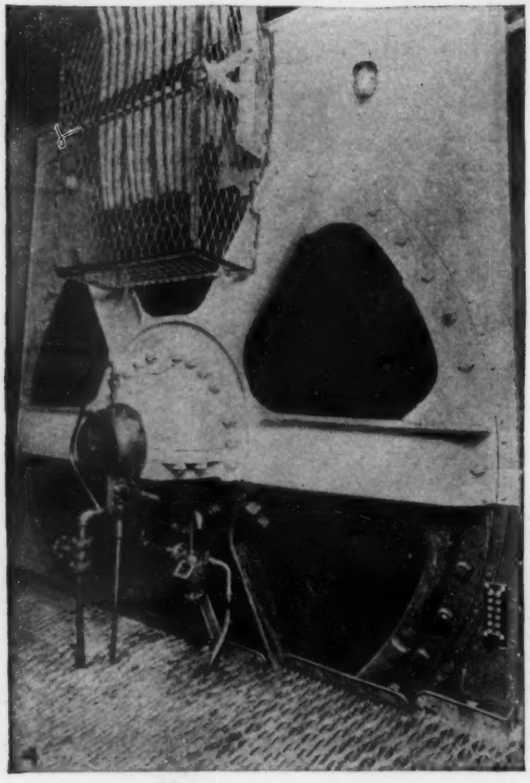


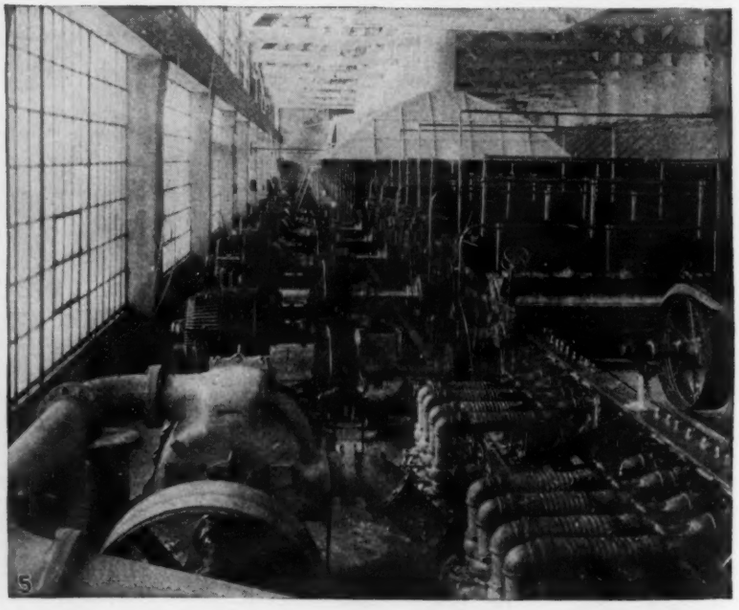
Nos. 1 and 3. In the textile industry accepted practice is to use individual motor drives even on the slow speed carding machines and feed rolls. (1) Cotton card driven by 1½-hp. motor. (3) Three-motor drive with electric trip for feed rolls on silk spinner.

No. 2. Twenty-seven oil wells pumped by one master jack driven by a 25-hp. motor in the Kern River oil fields. Electric drilling has also proved successful.

No. 4. The United States now has the only squadron of electrically driven battleships in the world. One of four 8,000-hp. propeller motors on the Colorado housed in a water-tight compartment.

No. 5. The paper industry has adopted electric drive and remarkable control developments have been made by electrical manufacturers.





Financial Aspects of Utility Growth

In Spite of the Prospective Enormous Growth of the Power and Light Industry During the Next Decade Money Cost Should Be Reduced— Financial Problems Are Stabilized

By Alfred L. Loomis

Vice-President of Bonbright & Company, Inc.

THE article on pages 17 to 24 in this issue of the ELECTRICAL WORLD presents a most careful and painstaking estimate of the probable growth of the power and light industry during the next ten years. The fulfillment of these predictions depends, among other things, upon the ability of the industry to raise the necessary capital.

The required capital, as indicated by the estimates of probable growth during the next ten years, will be at the rate of approximately $600,000,000 annually. The problem of obtaining capital to meet this demand and the question of what the cost to the power and light companies will be are subjects of interesting conjecture.

There are really only two sources from which the operating companies may obtain capital for these expenditures—(a) surplus earnings after dividends and (b) the sale of securities.

Although it is true that the companies as a whole are setting aside in depreciation reserves and expending in maintenance approximately 15 per cent of their gross revenues, or more than $150,000,000 a year, this must be considered only as taking care of the depreciation and obsolescence of their present investment of over $5,500,000,000 and as inapplicable to extensions.

Almost without exception, surplus earnings after dividends are being reinvested in the property. It is difficult to judge what this annual figure will amount to as it depends upon many factors, but for the purposes of argument it may be estimated that an annual sum of $50,000,000 will be available to go toward financing additions and extensions.

CUSTOMER OWNERSHIP AN IMPORTANT ELEMENT

This leaves at least $550,000,000 a year that must be raised from the sale of bonds and preferred and common stocks. Judging by the experience of the past few years, not more than $75,000,000 of this sum will be raised from the sale of common stocks. The preferred stocks will probably be largely sold through "customer ownership" campaigns. Two hundred million dollars a year to be thus raised is an extremely low estimate. In 1922 $175,000,000 was sold by this method, and the probable figure for 1923 is more than $300,000,000. A ten-year average of $200,000,000, therefore, is decidedly conservative, but may be allowed to stand. There remains $275,000,000 a year to be raised through the sale of bonds, to which should be added approximately $125,000,000 a year to refund maturing and called issues, or a total of $400,000,000 a year to be raised through the sale of bonds and notes.

This program is reasonable. Reduced from annual to weekly requirements, it calls for average weekly bond offerings of $10,000,000 during all but the midsummer weeks, when little financing is practicable. These figures are lower than those that have obtained during the past two years.

WHO ARE BUYING POWER AND LIGHT SECURITIES?

There is no doubt that substantially all of the holders of the maturing bond issues of power and light companies will reinvest the proceeds in the industry. The record of the industry is too good to expect otherwise. The preferred stocks will probably be bought locally by customers in small lots with money that is going into the industry for the first time. And in this connection it behooves the industry to see to it that none but the soundest of preferred stocks are thus locally offered, as most of the local stockholders, who have very generally taken their money from the savings banks to put into such stocks, might well become panicky if any conspicuous default should occur. The whole movement might thus be retarded throughout the country.

The money for the purchase of bonds will come from many sources. A few may be mentioned. It is a matter of record that the institutional holdings of power and light securities are increasing in a proportion far in excess of that of any other type of security. Insurance companies in particular have proved active buyers. Records show that the average insurance company has 20 per cent of its funds invested in public utilities today as compared with about 11 per cent five years ago. While these figures include other utilities besides power and light, the percentage increase is significant.

Educational institutions also are gradually appreciating the merits of this type of investment. Harvard College, for example, has shown a marked preference for public utility securities during recent years, the statement being made that they now have $8,000,000 invested in public utilities. Many other colleges are falling into line in this respect, and there are many instances of their investment funds showing a holding of public utility securities considerably larger than that of railroads.

Carrying this a step further, we find the same tendency in the investment of the endowment funds of schools. The most recent treasurer's report of St. Paul's School (Concord, N. H.) shows a total public utility investment of $537,226.46, which constitutes over 25 per cent of the total fund and compares with $405,102.61 which the school has invested in railroad securities.

National and state banks are giving increasing atten-

tion to the purchase of power and light securities. In respect to savings banks, there has been during the past year considerable agitation to modify the laws regulating their investments. It is highly probable that long before the end of the ten-year period these laws will have been altered and a great new purchasing power will have been opened to power and light security sales efforts.

There is another important element entering into any consideration of public utility financing during the coming years. The great demand on capital for industrial purposes which came with the war and immediately thereafter has slackened perceptibly, and there is no reason to believe that it will increase disproportionately in the near future. The steam railroads are no longer expanding rapidly, and their demands for new capital are, therefore, relatively considerably less than during the period of their expansion.

The federal government, moreover, is steadily reducing its total debt and thus releasing capital, part of which at least will find its way to power and light securities.

New issues of state and municipal tax-exempt securities will absorb capital, but because of their relatively low yield they are not really competitive with power and light securities, particularly as regards the vast number of small investors.

Where the Money Will Come From

About $600,000,000 annually will be required by the light and power industry during the next ten years. Of this sum $50,000,000 will be supplied from surplus earnings. Over $200,000,000 annually should be obtained through "customer ownership" sales and $400,000,000 per year must be raised through the sale of bonds and notes.

What Will the New Money Cost the Companies?

Power and light companies may fairly reckon that the cost of new financing during the next decade will be materially reduced from what they have experienced during the last few years. There are many factors tending in this direction, in addition to the fact that the country as a whole will probably not have to go through another period of heavy overinflation in the near future.

While the actual "rate" for money will fluctuate from year to year with the general business cycle, there are other factors that affect the final net cost to the companies. It might be well to bring out the significance of some of these other factors by comparing two hypothetical companies. One company has a flexible "open-end" first mortgage under which bonds can be issued for new construction. The other has a closed first mortgage with a heavy sinking fund. The first company does not have to issue in normal times any short-term securities with their relatively heavy discounts, nor does it have to "call" such securities before maturity at even greater expense. Neither does it have to meet the great expense of a sinking fund, and, most important of all, the new securities of the first company can be offered as "first mortgage" bonds and thus command a relatively higher price than the new securities of the other company, which must be sold as second or "refunding" mortgage bonds, since its first mortgage is closed.

These things mightily affect the "final net cost of money," and they serve to show that the companies that plan their financial structures with the same care that they devote to their physical plants will be the ones most to benefit. Constant improvements are being devised in this matter of financial structure. There are now investment banking houses that specialize almost exclusively in power and light securities and thus come to see the financial problems of the industry in all its phases. Such houses are co-operating with the companies with which they are associated in devising and developing the very best and most modern financial structures to fit the individual need of particular companies. No company should be satisfied until it has worked out a definite financial program for the next decade as many of the progressive companies already have done.

It is our firm belief that such financial programs will be adopted by the industry generally, and that we shall see less and less of expensive short-term, or temporary, financing and less and less of drastic changes in financial structures with the accompanying expensive necessity of "calling" securities at a premium.

It is principally for these reasons that we firmly believe the "final cost of money" to the progressive power and light companies will steadily decrease.

Coupled with this there are also other factors tending in the same direction, notably the constantly increasing preference for power and light securities among investors and the probable change in the laws governing the investments of savings banks.

The American public is also beginning to realize that commission regulation is tending to increase rather than decrease the safety and stability of their investments. And finally as each year goes by the stable record of the utility companies in the electrical industry will become longer and longer.

As a basis upon which to compare future costs we have just compiled figures that show that there are today fifty-six bond issues of $10,000,000 or more of power and light operating companies (as distinguished from holding companies). At present quotations their average yield is 6.05 per cent. There are thirty-eight issues of preferred stocks of such companies of $5,000,000 and more, and their average yield is 7.24 per cent.

Conclusion

Just as from the technical aspect the industry is no longer in an "experimental stage" and no longer expects radical changes over night, so also the financial problems are becoming more and more stabilized. While the technical men expect to see vast improvements during the next decade, they expect them to come as extensions and gradual modifications of present practices. So also the financial men expect that the financial problems will be solved along existing methods. There will be steady and constant improvements in methods, but probably no sudden or radical departures. In short, we believe that progressive and efficiently operated companies will experience no difficulty in obtaining at reasonable cost all capital necessary for their expansion and growth.

Standardization Means Economy

American Engineering Standards Committee Has Made Much Progress and Established a Sound Basis for Further Development—The Committee Serves as a Democratic Clearing House for Co-operative Interests

By Albert W. Whitney

Chairman American Engineering Standards Committee

THE past year from the point of view of the American Engineering Standards Committee has been chiefly notable for a steadily increasing realization among industrial leaders of the supremely important part that standardization is to play in the increase of industrial efficiency and for a steady and wholesome but not spectacular progress by the American Engineering Standards Committee itself, marked by substantial work accomplished on various important projects, but even more by the continuing solidification of the basis upon which the important work of the future will rest. It continually becomes more apparent that the American Engineering Standards Committee was organized along fundamentally right lines. The wisdom of three points in particular stands out with special clearness: First, that the American Engineering Standards Committee serves as a clearing house pure and simple and not as a body that initiates projects or that does the technical work of making standards; second, that definite provision is made that the work at every stage shall be handled in a thoroughly representative and democratic way, and, third, that the organization rests upon a basis of complete co-operation between all interests concerned. The relationship, for instance, that has been established between industry and the government has been particularly wholesome and successful and has on both sides been definitely helpful.

The American Engineering Standards Committee has begun to feel to some extent the greater amplitude in its work that has come from the results of its campaign for sustaining memberships. It has, for example, recently added to its staff an engineer-translator, whose particular job will be to keep more intimately in touch with foreign developments. Steps are being taken to push the campaign for sustaining memberships still more vigorously during the coming year.

The development of the American Engineering Standards Committee in general has been exemplified in particular in the developments in the electrical field. No other field is more abundant in its standardization needs, and the electrical industry has been thoroughly appreciative of the situation and has certainly been among the most constructively helpful of all the member groups in the development of the work of the committee. It has been interesting to note the growth in the sentiment for national standardization in this industry even during the past year.

Electrical Projects Before the American Engineering Standards Committee

The projects that are now under way that are of special interest to the electrical industry are listed below with annotations regarding their present status:

Electric Power Control Safety Code.—Work in hands of technical committee.

Lightning Protection Safety Code.—Draft specifications under consideration.

Terminal Markings for Electrical Apparatus.—Work practically completed.

Rating of Electrical Machinery.—Draft specifications under consideration.

Insulated Wires and Cables (Other Than Telephone and Telegraph).—Work divided into twelve sections: Definitions, Conductors, Stranding, Rubber Insulation, Impregnated Paper Cable, Varnished-Cloth Insulation, Magnet Wire, Fibrous Coverings, Metallic Coverings, Standard Make-ups for Rubber Insulated Wires, Export, and Weatherproof Heat-Resisting and Similar Wirings.

Symbols for Electrical Equipment of Buildings.—Work of sectional committee completed and before sponsors.

Electrical Properties of Aluminum.—Work in hands of technical committee.

Specification for Tubular Steel Poles.—Sponsorship assigned and sectional committee about to be organized.

Specification for Wooden Poles.—Sponsorship assigned and sectional committee about to be organized.

Radio.—Decision made to undertake standardization.

Overhead-Line Material.—Scope of the project under revision with particular reference as to how much line material for different industries—communication power and railway—is susceptible of common treatment.

Regulations for Electric Wiring and Apparatus in Relation to Fire Hazard ("National Electrical Code").—Revision under way by sectional committee.

Electrical Safety Code ("National Electrical Safety Code").—Present edition, approved 1922, Parts 2 and 4 under revision by sectional committee and revision of Parts 1 and 3 now being initiated.

Rules for Electricity Meters.—Present edition approved 1922; work on revision in hands of sectional committee.

600-Volt Direct-Current Overhead Trolley Construction.—Approved 1923.

It had been hoped that before the end of the year a final report of the sectional committee on rating of general utility motors, including the so-called 40-deg.-50-deg. question, could have been completed. Owing to a variety of circumstances, including the discussion at the meeting of the International Electrotechnical Commission in Geneva and the detailed consideration of the question by the more important American organizations, this has not been possible.

This list contains only those projects which are classified as primarily within the electrical engineering field, but so ramified are the interests of the electrical industry that there is scarcely one of the 150 projects before the American Engineering Standards Committee which does not bear directly or indirectly upon some branch of the electrical industry. For example, the American Institute of Electrical Engineers is represented on twenty-three committees, the National Electric Light Association on twenty-four, the Electric Power Club on eighteen, the Associated Manufacturers of Electrical Supplies on eight, and the American Electric Railway Association on thirty-seven.

Standardization in the electrical industry was already very far advanced at the time of the organization of the American Engineering Standards Committee. The broadening of the electrical standardization work to

put it on a truly national scale has naturally introduced a considerable number of problems of readjustment which the various organizations which speak for the electrical industry have been and still are working out. The American Institute of Electrical Engineers, American Electric Railway Association, Electric Power Club, Associated Manufacturers of Electrical Supplies and National Electric Light Association have all been modifying the administrative procedure which had been developed in their respective organizations in order that a large amount of their work (in some cases all) should receive the approval of the American Engineering Standards Committee as American standard.

A simple organic relationship between the work of the United States Committee of the International Electrotechnical Commission and that of the various electrical organizations and the American Engineering Standards Committee has yet to be worked out; however, a committee appointed for the purpose now has this question under consideration.

During the year there has been a very considerable activity in the preparation in preliminary form of standards in the electrical field which in their final form will be presented for adoption as American standard.

General Industrial Standardization.—More than 150 undertakings now have official status before the American Engineering Standards Committee, as the national clearing house for standardization. Fifty standards have received final approval by the committee, twenty-two of which were approved during 1923. The importance of the broadly democratic methods followed in this clearing-house work is receiving increasingly widespread recognition. In it all who are concerned with any standard—producers, consumers and representatives of the public and government—participate (1) in deciding whether the work should be undertaken at all, (2) in formulating the standard and (3) in its ultimate approval. Thus the industries are developing and using such standards as best fit their needs, without danger of such technical industrial matters becoming subject to legal enforcement or to governmental pressure. Is it not probable that many other of our important industrial problems will find their solutions by closely analogous methods?

A recent striking development is the increased systematic use of specifications in public purchases, notably in the federal and in several of the state governments. The National Association of Purchasing Agents and the National Council of Governmental Purchasing Agents are devoting much time and attention to the subject. At the direction of Mr. Hoover, the Department of Commerce is preparing to publish a "Dictionary of Specifications for Public Purchases," which will make easily available information as to what specifications are in existence, to what classes of use they apply and how they may be obtained.

The Federal Specifications Board has completed the second year of its activity. In this the American Engineering Standards Committee has co-operated by obtaining criticisms from the various interested industries of proposed specifications of the federal government before the specifications are finally adopted by the board. To date the board has adopted approximately ninety specifications, and the committee has secured criticism from industry on about the same number. From these systematic efforts to bring governmental purchases in line with the best commercial practice important economies both to industry and government are resulting.

The Division of Simplified Practice of the Department of Commerce continues to exert a most stimulating influence on the standardization movement, particularly in emphasizing the efficiency results of standardization to the business man.

International Standardization.—In July the second conference of the national industrial standardizing bodies was held in Switzerland, where thirteen of the more important industrial nations of Europe and America were represented. Important progress was made in developing co-operation between the various national bodies, particularly in regard to the early release to one another of information on work in progress. Information on the status of all projects in hand is now regularly interchanged between the various bodies. Provision was made for continuing the work of the conference on the many problems of common interest, through a continuing loose-knit organization.

There are now national industrial standardizing organizations in sixteen countries—Australia, Austria, Belgium, Canada, Czechoslovakia, France, Germany, Great Britain, Holland, Hungary, Italy, Japan, Norway, Sweden, Switzerland and the United States. Of these, the work in Great Britain, Germany and the United States is the most extensive, as would be expected from the scale of industrial development in these countries.

The extensive standardization work going on in Germany continues to present many interesting phases. Some of these were outlined in a recent bulletin of the American Engineering Standards Committee. Practically every important manufacturing concern in that country is actively engaged in the work, and more than a thousand companies have formal standardization organizations within their own works. Approximately seven hundred national German standards have been approved by the central national standardizing body. These are only standards in which several industries are concerned.

Standardization engineering is now a recognized profession in Germany. Some of the consulting engineering firms specialize on standardization work. Through their work on trade catalogs these consulting engineers, among other things, are introducing standardization into sales policies and sales organizations.

Of interest not only in its relation to international standardization, but also on account of its bearing on the use of specifications in foreign trade, is the resolution passed by the last conference of the Pan-American Union, where it was resolved "that a conference on standardization of specifications of materials, tools, machinery and supplies be held . . . with a view to reaching agreements which may be embodied in the Inter-American conventions on this subject." This projected movement will be watched with great interest by American industries.

The council of the International Electrotechnical Commission met in Paris on Dec. 3, but no technical standardization work was undertaken. Guido Semenza of Italy was elected president and Dr. C. O. Mailloux of the United States was elected honorary president. Tentative plans were made for meetings of some of the technical advisory committees in the near future.

Standardization and Trade Associations.—Standardization continues to play a more and more important rôle in the activities of trade associations. The subject

is treated at length in the book "Trade Association Activities" issued by the Department of Commerce during the year. It is of more than passing interest that the Supreme Court in a recent decision in regard to trade association activities explicitly recognized standardization as being in the public interest.

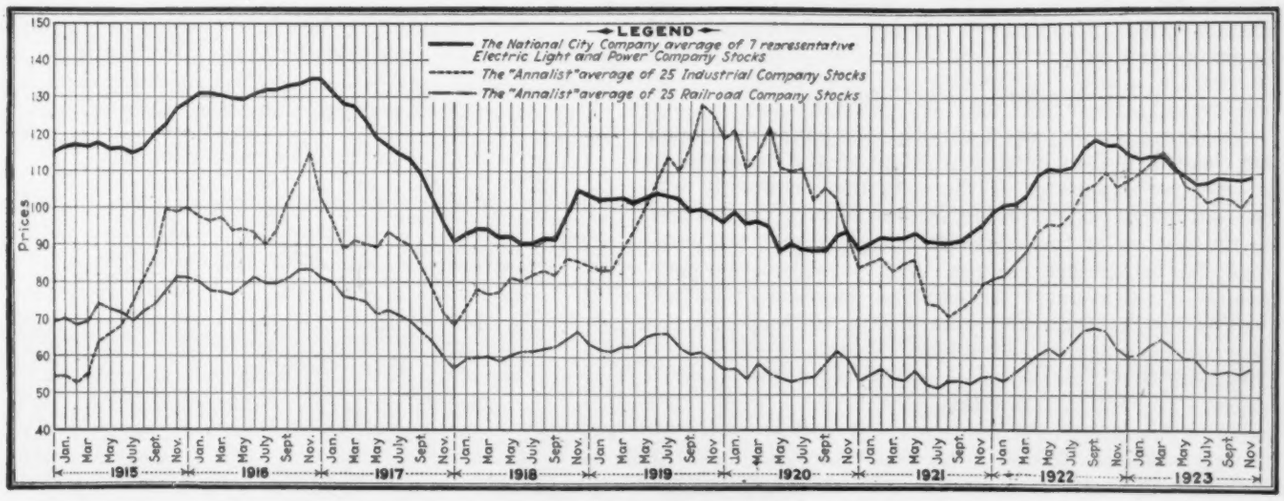
Proper Field of Standardization.—The questionings that now arise more and more frequently with regard to the possibly adverse effects of standardization are to be taken as an indication of the increasingly important rôle that standardization is playing. A force goes unnoticed until it begins to show its power. Standardization, however, unquestionably has its dangers like any other powerful instrument, and it should be very definitely a part of the work of the American Engineering Standards Committee to be deeply thoughtful to see that standardization is developed in such a way as to produce the greatest good with the least evil. This will require a breadth of view that must go beyond the question of mere material accomplishment. The matter must be viewed as a problem in the philosophy of industry; it must be considered from the social point of view as well as from the purely economic. The American Engineering Standards Committee as a leader in the standardization movement feels deeply responsible for seeing that the development takes place along right lines.

Utility Financing During 1923 Establishes Record

Large Increase in Sales of Securities Commensurate with the Great Expansion of Industry—Public Offerings and Customer Ownership Sales of Preferred Stocks Heavy

By David C. Johnson

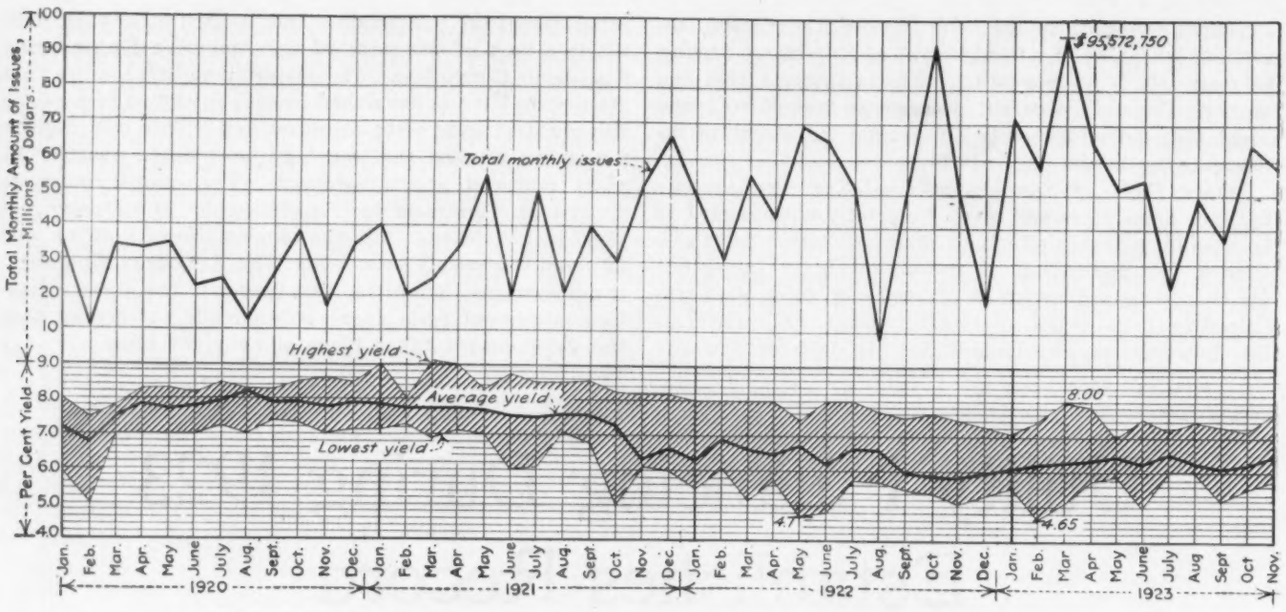
Public Utilities Department, the National City Company



NINE-YEAR TREND IN AVERAGE PRICE OF ELECTRIC LIGHT AND POWER STOCKS AS COMPARED WITH INDUSTRIAL AND RAILROAD STOCKS

THE financing of electric light and power companies during 1923 reached a total exceeding the records of all previous years, notwithstanding a period of unusual inactivity during the summer months. According to statistics compiled by the ELECTRICAL WORLD, the total amount of bond, note and stock financing of the companies conducting primarily an electric light and power business aggregated $747,721,900—an increase of more than $152,000,000 over the figures for 1922. A substantial number of securities included in the compilation are those of companies which operate gas or street-railway departments in addition to their electric business, but the amounts which should be properly allocated to such departments are relatively small. On the other hand, the figures represent only public offerings by investment houses and do not include any part of the approximately $250,000,000 which is stated to be the sales of securities, principally of preferred stocks, made by public utility companies directly to their customers.

The month of January made an auspicious start, when more than $71,000,000 of securities were offered. This pronounced activity continued until July, when, owing to an oversold condition of the market, accompanied by a combination of unfavorable general conditions, some of which were largely sentimental, new



ELECTRIC LIGHT AND POWER FINANCING BY MONTHS SHOWS GENERAL UPWARD TREND AND YIELD OF NEW SECURITIES FAIRLY CONSTANT DURING 1923

offerings of securities decreased to $23,000,000 for the month. During the next two or three months this stagnant condition continued, it being found very difficult to sell securities, not only of public utility companies but of all kinds. Toward the close of the year, however, conditions improved materially, and the large amount of new offerings was readily absorbed, the banner month of the year being December, with a total of more than $119,000,000 of new electric light and power securities.

RECORDS ESTABLISHED

The large amount of electric utility financing during the year is not surprising in view of the present and prospective expansion of the industry. Not only was the output as expressed in kilowatt-hours the largest in the history of the industry, but gross and net earnings also established records. The central-station companies of the country reported an increase of 26 per cent in output over that recorded in 1922 and 20 per cent larger gross revenues from the sale of electricity. The fact that the kilowatt-hour sales increased by a greater percentage than the revenue, of course, indicates a reduction in the average price paid for energy. A recent survey by the ELECTRICAL WORLD indicates that the peak in the rate of growth of the electric light and power industry by no means has been reached, nor will it be for many years. It is stated, and correctly so, that the progress in civilization shown by a people may be measured by the electrical energy consumed per capita. Unless we are willing to drop back into a primitive mode of living, it follows that the electric light and power industry must continue to grow, and with the constant introduction of new electrical devices and apparatus, which either become essential to industry or help make our every-day life better worth living, this increase must continue at an accelerated rate.

Refunding operations during 1923 were very substantially less than in the preceding year, owing not to the fact that maturities of utility securities were fewer, but that in 1922 many high-interest-bearing securities were called and refunded with bonds bearing lower coupon rates. With a larger percentage of the financing in 1923 representing new capital, the record amount of new offerings of the electric light and power companies becomes even more impressive. Sales of securities of electric light and power companies were several times those of the other classes of utilities, including telephone, gas and electric railway companies.

Public offerings of preferred stocks and other junior securities were particularly large. In addition, the

ELECTRIC LIGHT AND POWER SECURITY ISSUES IN 1923

PUBLIC SALES BY INVESTMENT HOUSES

	Amount of Issue	
MORTGAGE BONDS (average yield 6.12 per cent):		
1 issue yielding 4.65 per cent	$200,000	
14 issues yielding from 5.00 to 5.70 per cent	69,401,000	
20 issues yielding from 5.75 to 5.93 per cent	77,717,000	
60 issues yielding from 6.00 to 6.25 per cent	209,865,200	
23 issues yielding from 6.30 to 6.45 per cent	50,055,000	
48 issues yielding from 6.50 to 6.80 per cent	98,071,900	
5 issues yielding 7.00 per cent	5,345,000	
1 issue yielding 7.04 per cent	3,000,000	
172 issues		$513,655,100
DEBENTURES (average yield 6.65 per cent):		
1 issue yielding 5.95 per cent	$1,500,000	
7 issues yielding from 6.25 to 6.80 per cent	31,000,000	
8 issues yielding from 7.00 to 7.25 per cent	18,550,000	
16 issues		51,050,000
NOTES (average yield 6.74 per cent):		
1 issue (yield not given)	$1,000,000	
1 issue yielding 5.70 per cent	1,500,000	
10 issues yielding from 6.00 to 6.75 per cent	18,930,000	
9 issues yielding from 7.00 to 7.50 per cent	14,700,000	
21 issues		36,130,000
PREFERRED STOCK (average yield 7.05 per cent):		
11 issues yielding from 6.00 to 6.98 per cent	$37,400,000	
14 issues yielding from 7.00 to 7.49 per cent	59,426,000	
15 issues yielding from 7.50 to 7.87 per cent	20,860,800	
1 issue yielding 8.00 per cent	1,000,000	
41 issues		118,686,800
MISCELLANEOUS ISSUES (average yield 6.46 per cent):		
1 issue (yield not given)	$15,000,000	
1 issue yielding 5.40 per cent	1,000,000	
4 issues yielding from 6.00 to 6.75 per cent	12,200,000	
6 issues		$28,200,000
Total of all issues of year		$747,721,900
ESTIMATED LOCAL SALES TO CUSTOMERS		$250,000,000

companies were very successful during the year in financing a large part of their requirements through the sale of preferred stocks in the territories in which they operate. Financing of this character has many advantages. Not only does it furnish a very satisfactory means of raising substantial sums of money necessary for the expansion of the industry, but it creates favorable local interest in the prosperity of the company. In addition to the funds raised through the offerings by investment bankers and the customer-ownership sales, large sums for property expenditures were provided out of surplus earnings of the companies, which not only took care of part of the expansion of the business, but operated to increase substantially the equity for the securities outstanding in the hands of the public.

Month-by-Month Analysis

An analysis of the fluctuations and rate of return, month by month, is shown in the accompanying graph. It will be noted that the average yield was fairly constant throughout the year, but with a slightly upward trend. The offerings during January, 1923, yielded an average of 6.08 per cent, the lowest for the year, and, after undergoing some fluctuations, the average rate closed in December with 6.50 per cent. It is not unlikely that the market was stimulated by the generally higher yield of new offerings during the closing months.

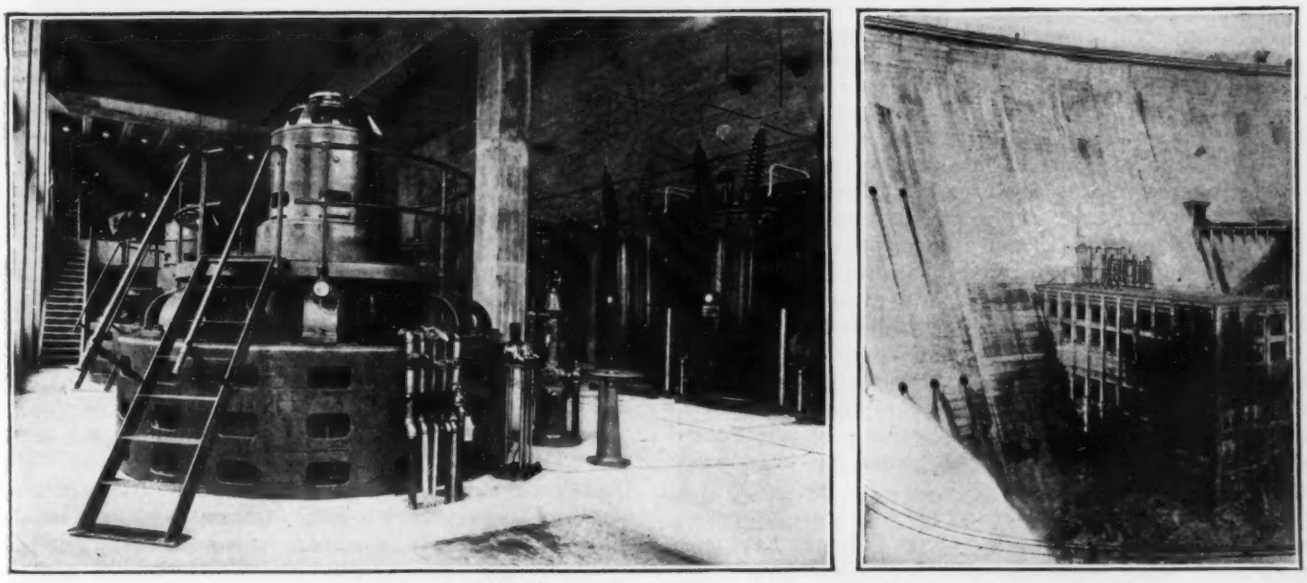
Another chart is shown of the average price of electric light and power stocks as compared with industrial and railroad stocks. The trend of prices of the seven electric light and power stocks selected by the National City Company was fairly constant throughout the year, with a slightly downward tendency. The same general trend is indicated by the curve of average prices of twenty-five railroad company stocks as reported by the *Annalist*, but, as would be expected, the range in the prices of stocks of industrial companies is much more marked.

The prices of public utility bonds, of course, fluctuated to a much less extent than is indicated by the chart of stocks. An average of the prices of fifteen utility bonds as compiled by the National City Company showed a decrease for the year of about two and one-half points, which is slightly less than the decrease in the average of representative industrial and railroad bonds, and indicates that the small drop in prices was caused by general market conditions and money rates, rather than by a reduction in the intrinsic value of the securities. As a matter of fact, general conditions in the electric light and power industry were never better, as evidenced by the increase in sales and earnings commented upon above.

In addition to the approximately $5,000,000,000 bonds and stocks of electric light and power companies held by 1,500,000 individuals, many hundreds of millions of these securities are owned by banks, insurance companies and other institutions. Taking into consideration the 27,000,000 depositors in banks, of whom half are savings bank depositors, and the 50,000,000 holders of life insurance policies, practically every individual in the United States should be intimately concerned in the prosperity of electric light and power companies. It is only within recent years that public utility bonds have been recognized as legal investments for savings banks, but already they are legal in eleven important states, and many others are considering modification of their laws in this respect.

The essential character of the service rendered and the diversity of the sources of income, together with the stability of the business as indicated by the steady and continuous increase in earnings month by month and year by year, make the bonds and stocks of electric light and power companies one of the most desired and secure class of investments, and the increase in size of issues commensurate with the great expansion of the industry has resulted in recent years in a much broader market for these securities.

An Unusual Station in the West Which Has No Low-Tension Switching or Buses



Generators are connected directly to transformers in the Don Pedro power house. At the right is the Don Pedro dam and power house in the Modesto-Turlock Irrigation District

Lighting Developments in 1923

Improvements in Illuminants, Equipment and Practice—Notable Increase in Intensities and Wider Recognition of Values of Good Illumination—Possibilities of the Future

By G. H. Stickney

Chairman Committee on Illumination A. I. E. E.; Edison Lamp Works

THEATERS HAVE CAPITALIZED ILLUMINATION TO A VERY GREAT DEGREE—LOBBY OF GRANADA THEATER IN LOS ANGELES, CAL.

IN ORDER properly to picture the engineering progress in lighting for 1923 it seems necessary to view it with the background of the past. Following the radical increases in efficiency culminating in the development of the gas-filled tungsten lamp, there came a period of rapid development of diffusing and reflecting equipments and a development of new practices. So rapidly did these improvements come that they have not been entirely assimilated by the public or even by the commercial branches of the lighting industry. Although there have been marked advances in lighting practices, many practices of real merit have been applied on a relatively small scale only, while the practices in general have lagged behind the lamp and equipment development.

In contrast with this the year 1923 stands out as one in which the commercial branches of the industry have cooperated to better advantage than before and have promoted better equipment and practices. They have found the public surprisingly receptive and have been successful in starting movements which promise to close the gap and put the engineering knowledge and equipments to better use.

Thus 1923 has proved a year of considerable commercial prosperity, although not one of remarkable engineering development. This does not imply that there have been no developments, but rather that, by contrast, increases in efficiency of a few per cent attract but little attention, while intangible improvements for which there is no numerical expression attract even less. In discussing the developments specifically it seems practicable to classify them in three groups—namely, those of illuminants, of equipments and of practice.

Developments are continually being tried out on incandescent lamps. They are too numerous to mention. Some of them result in minor improvements in efficiency, strength, adaptability or manufacturing convenience. In the aggregate over a period of years they amount to considerable.

The most far-reaching and conspicuous improvement of 1923 is the tipless construction. Tipless lamps were made at least a decade ago, but a new construction now permits them to be manufactured advantageously. The tipless construction is being adopted for the various styles of lamps—type by type—as far as practicable.

Another improvement is a new type of machine for manufacturing lamps complete. While this may not produce any change recognizable by the user, its importance is attested by the fact that certain manufacturers have scrapped their former machinery and radically rearranged their processes. Among other things, the new machinery facilitates the shifting of production from one class of lamps to another, thus permitting a more prompt response to changes in demand.

For lamps employing the helically coiled filament there has been a tendency to use a ring-shaped filament where the resulting light distribution was not unfavorable. The gas-filled tungsten lamps of 200 watts and less have been changed over to this form. A similar form of filament has been applied to the 25-watt and 50-watt vacuum sign lamps, with a resulting increase in ruggedness and "end-on" candlepower.

Early in the year the tolerances of light center length of automobile headlight lamps were reduced by more accurate glass working. This step clears the way for the production of accurate headlights without focusing adjustment. It is hoped that this will reduce the practice of operating headlights with lamps out of focus, a serious cause of glare.

Diffusing-bulb lamps are now made with a sprayed-on coating of waterproof refractory material, which gives greater uniformity and control of density than could be secured with white glass. The 75-watt gas-filled lamp is made in this finish, in addition to clear glass.

The all-frosted has been recognized as one of the principal finishes for vacuum lamps. This should replace the bowl-frosted finish, since with the latter it is difficult to conceal the filament in open-mouth reflector equipments, and further, because the all-frosted, used with the common equipment, is now approximately of the same efficiency.

Many experiments have been made toward the production of light from luminous gases. While no new developments of the year appear to have provided a practical illuminant, the field seems to have possibilities. A large number of new equipments have been developed during the year. None of those in the regular fields of lighting, however, appear to embody any new elements or considerable improvements. They, however, added to the variety available. A combination metal reflector and glass globe developed for industrial lighting in the latter part of 1922 has proved its value, and several units of similar characteristics have since been produced. In commercial lighting squat globes have been the essential features of some new equipments.

In connection with the larger glass-globe luminaires there has been some development of safety holders designed to prevent the globe from falling either because of careless hanging or because of breakage of the supporting flange.

The motor vehicle officials of Massachusetts announced about a year ago that, beginning with 1923, they would enforce the state law requiring tail lights of automobiles to be so arranged as to illuminate the number plate. An investigation of some four hundred machines had revealed only one properly illuminated plate, and there was reason to believe that a similar condition existed throughout the country. As a result of the action in Massachusetts, all the principal tail-lamp manufacturers redesigned their equipment, so that most of the output in 1923 provided suitable illumination in accordance with the specifications adopted by the Illuminating Engineering Society and the Society of Automotive Engineers.

"GREAT WHITE WAYS" USING DAYLIGHT GAS-FILLED BULBS ARE NOW FOUND IN NEARLY EVERY CITY —A STREET SCENE IN CLEVELAND, OHIO

For several years, the railroads have been studying the question of electric light signals so that similar signals may be employed by day and by night. The Pennsylvania Railroad solved the problem by using rows of lamps to give a direction signal. About a year ago the Delaware, Lackawanna & Western Railroad installed colored signals of high power. A third railroad has developed a combination color and direction signal and is planning such an installation. In these signals the equipment is arranged so that they are illuminated only on the approach of a train. Much detail development has been made in improving the color and direction control of the light.

The progress in traffic signaling has called forth sev-

eral new developments, both for the type of equipment for controlling the movement of traffic and for that used as a warning at intersections. Many of the devices of the former type employ color, and in line with this feature it may be noted that a sectional committee is working on the co-ordination of all color light signals with railroad and navigation practice as an American engineering standard.

The indications are that the progress of better lighting practice has been somewhat accelerated during the year. Not only has good lighting extended more widely, but standards have been raised as to both intensity and diffusion. This is confirmed by the consumption of incandescent lamps, the preliminary estimates of which seem to indicate an increase of about 15 per cent in quantity of light furnished as compared with 1922.

In home lighting every considerable progress has been made in brightening up the kitchen. The wide success with which commercial efforts have been rewarded bears witness to the need and acceptability of this move. In other parts of the house progress has been made toward the concealing of brilliant light sources. In living rooms portable lamps are being more extensively employed to produce artistic effects.

Store and show-window lighting have shown notable improvement, presumably due to commercial stimulation based on engineering data brought out in 1922 and the first half of 1923. These data measured the reaction of improved illumination on the public. Color and spot lighting is being used more widely and effectively in show windows.

Good practice in the lighting of schools is being more extensively applied in new buildings, and the electric lighting of some of the older buildings is being brought up to date. In some cities plans have been made for a systematic redesign of school lighting over a period of several years. The revision of the "School Lighting Code" of the Illuminating Engineering Society is practically complete. A preliminary draft was presented at the Lake George convention, and it will probably be submitted soon to the sectional committee for consideration as an American engineering standard.

Though industrial lighting has not been especially active, what installations have been made have been generally of high standard, and some of them notably so. The tendency toward general lighting systems has continued, and the use of local lighting has been more rational.

A report of a thorough investigation of lighting in certain of the larger post offices has indicated the need of better diffusion and about double the illumination. The report states that, besides bettering conditions in the interest of welfare of the workers, the improved lighting will actually reduce cost of handling mail through increasing the speed of operatives and reducing fatigue.

Street lighting is very active, and practice is tending strongly toward the ornamental types of equipment in the residence streets as well as in the business districts.

IN ALL SECTIONS CITIES ARE ENGAGED IN REMODELING AND INSTALLATING STREET LIGHTING THAT ADDS TO THE ILLUMINATION AND ARCHITECTURAL BEAUTY OF THE STREETS

An unusual number of improved installations have been reported, and the emphasis on co-ordinating the practice throughout a city is a new and desirable feature. Highway lighting seems to be solving the problem of night driving on heavily traveled interurban thoroughfares. Such lighting has gained a real foothold during the year, with the promise of more rapid extension in the near future.

For a number of years agriculturists and horticulturists have been doing more or less experimentation to determine the relation of light to the control of plant growth. Several investigations reported during the year have brought out interesting data, and even more extensive research is under way. Although it is obvious that electric light cannot compete with daylight when daylight is available, the researches indicate that there are conditions where electric light can be used practically to supplement daylight in speeding plant development—for example, in forcing blossoms for a holiday market.

As has been shown, the rapid advances in practice of the past year and those anticipated for the coming year are especially of a promotional nature, but as such they are sure to stimulate the engineering development of the future.

Interconnection in 1923

"Electrical World" Map, Produced as a Result of Nation-Wide Survey, Shows All Interconnections and Transmission Lines of 11,000 Volts and More—They Form a Veritable Network Over a Large Portion of the United States

"SUPERPOWER" and "interconnection" are words whose use has so spread over the entire country, particularly during 1923, that they may almost be said to be bandied about in the everyday conversation of all classes of people. In general, as has been pointed out in these pages many times before, these words are used to express an idea or ideas whose consummation or realization is a thing to come in the future, and there is little knowledge of the extent to which the electrical industry has even now developed along the very lines which these terms signify. As is known to some, but unfortunately not to all even within the industry itself, superpower and interconnection mean merely the substantial and intelligent interconnection of various electrical systems, the building and utilization of large power-producing stations, either steam or hydro, as base plants wherever that development is feasible, and the consequent construction of transmission lines to carry large blocks of power from power-producing centers to utilization or load centers. Within the industry likewise the extent to which interconnection has taken place is known or realized, not in its entirety, but only to a somewhat greater degree than is appreciated by the general public.

To try to present to the industry, and through the industry to the general public, the present condition of interconnection and transmission in the United States, the ELECTRICAL WORLD has during the past year, with the complete co-operation of the United States Geological Survey, made a nation-wide study and has produced a map showing the electric transmission lines of the United States which is published as a supplement to this issue. On this map are shown, grouped in four divisions by voltages, all interconnecting and transmission lines of 11,000 volts and over—excepting in some few congested areas where a large number of duplicate lines or lines connecting a small group of very closely associated stations would be so close together as to form practically a black spot—for example, northeastern New Jersey adjacent to New York City. In addition, there are shown on the map all generating stations in the United States. The map has been produced in a size which will allow it to be placed under a glass on top of the regular-sized office desk.

Every effort has been made to have this map correct and up to date within a few months at least. Local data from the ELECTRICAL WORLD and from the United States Geological Survey were gathered together, and virtually all of the resulting original sketches were sent to the companies in the territories to which these sketches applied for correction in the field. Even with all this care, there are doubtless some errors in the map, and, inasmuch as the attempt will be made to keep it up to date, companies noticing any errors or omissions are requested to communicate with the ELECTRICAL WORLD.

It is well to call attention to one feature in the interpretation of an interconnection or transmission-line map such as this one. The point which should be remembered is that all of the lines shown on this map are not what might be termed transmission lines in the sense that large blocks of power can be transferred. For example, while it may be possible to trace connecting lines between points a thousand miles apart, and thus be theoretically possible for a kilowatt-hour to be delivered from one end of the line to the other, nevertheless this does not constitute a transmission line from one end to the other for any appreciable amount of power. This statement may sound elementary to some, but the misinterpretation applied by many to maps such as these makes it advisable to repeat it in this discussion.

LARGE COPIES OF MAP AVAILABLE

The original drawing of this map is 100 in. by 64 in., and the ELECTRICAL WORLD is in a position to furnish reproductions of this original map all in black line on white paper or cloth, either mounted on rollers or unmounted, in case such reproductions are desired by any of its readers.

Electric Power and Light Companies of the United States

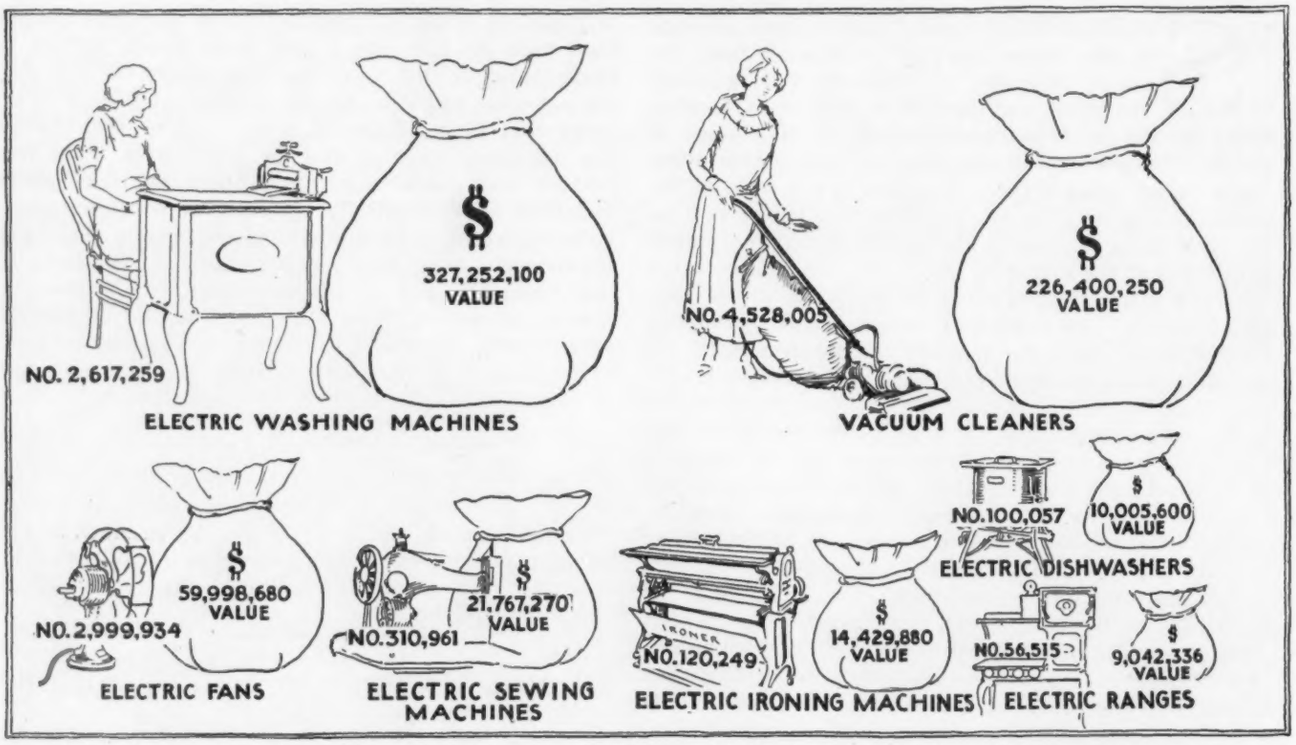
With Sectionalized Map of Transmission Lines

IN A 234-PAGE book under the above title, Bonbright & Company, Inc., investment bankers, New York, have gathered a great deal of interesting and valuable information about all of the electric light and power companies in the United States. Primarily the book is a collection of maps of individual states, a list of all towns served by central stations, a statement of the ownership of the central stations and some financial data about the companies involved. There is indicated on the map of each state all central stations in towns of 2,500 population or over. These central stations are indicated by symbols which define the ownership of the central stations as shown by an accompanying list. In addition, there is also shown the capitalization of all of the companies, how it is divided between common and preferred stock and funded debt, and also the gross and net earnings of each of the companies for the fiscal year ended Dec. 31, 1922. This book thus presents a valuable nation-wide survey of the central-station industry with reference to capitalization, earnings and ownership.

One section of this book includes, in nineteen sections, the transmission-line map of the United States which is published as a supplement to this issue of the ELECTRICAL WORLD.

The book is directed principally to investors and prospective investors in electric light and power securities. Copies may be obtained by inquiry direct to Bonbright & Company, Inc., 25 Nassau Street, New York.

More than 8,000,000 Potential New Buyers of Domestic Electric Appliances



NUMBER AND VALUE OF CERTAIN APPLIANCES WHICH WOULD PROBABLY BE PURCHASED IF THE UNWIRED HOMES OF THE COUNTRY WITHIN REACH OF CENTRAL-STATION LINES WERE WIRED

The Wiring of Unwired Homes Within Reach of Central-Station Lines Means the Probable Sale of Millions of Electric Appliances and a Large Increase of Central-Station Revenue from Their Use

BASED on the study which the ELECTRICAL WORLD has been making during the past year of the number of potential central-station customers in the various counties of the states of the Union, it is estimated that there are at present 8,175,510 homes in the country possible of future electrification. In this sense a home is considered as the abiding place of a family, so that the number of actual houses possible of future electrification is considerably under the above figure on account of the large number of multi-family houses in the large cities.

The accompanying tables indicate the value of the potential central-station customers as probable purchasers of certain electrical appliances, and also the probable revenue which the central station will derive from the sale of energy through the operation of these appliances. No attempt has been made to cover all appliances which would probably be purchased by these developed customers, otherwise flatirons, toasters, curling irons, etc., would undoubtedly have been included in the list. The intention is to indicate the large potential value of these possible central-station customers as purchasers of electrical apparatus.

The basis for the probable number of units sold per thousand customers was determined after a careful study of the confidential sales records of one of the largest national distributors of electrical appliances in this country, in conjunction with data on the subject which have appeared from time to time in the columns of *Electrical Merchandising*. The unit figures are believed to represent within a fair degree of accuracy the probable purchasing value of the various sections of the country for the seven types of electrical appliances indicated.

What these purchases mean to central-station companies in the way of increased revenue from the sale of energy is indicated under the various types of apparatus. Of these seven appliances, vacuum cleaners appear to be big producers of central-station revenue, not only on account of the large numbers which are purchased, but also on account of the large number of service-hours per year.

Taking these seven types of apparatus as a whole, the indications are that the larger field for development lies in the Middle Atlantic States, followed by the East North Central States. The types of people making up the population, prevalence of low-priced electrical energy and climatic conditions determine the sales of appliances in the various sections.

Of all the many domestic electrical appliances now on the market, the electric flatiron, the vacuum cleaner and the washing machine have been most widely adopted by the housewives of the country. These three appliances have raised the womanhood of the country from a life of drudgery to one of comparative ease. Estimates of the use of the electric iron by the potential central-station customers are not included in the accompanying tables for the reason that no reliable basis for making such an estimate was obtainable. Estimates, however, are given for both vacuum cleaners and washing machines.

It is estimated that of the 8,175,510 potential domestic lighting customers, 4,528,005 would purchase vacuum

Table I—Value, When Wired, of Unwired Homes Within Reach of Central-Station Lines as Probable Purchasers and Users of Vacuum Cleaners

Section	Number of Pctential Domestic Lighting Customers (Not Including Present Customers)	Probable Number of Vacuum Cleaners per 1,000 Customers	Total Probable Number of Vacuum Cleaners Sold if Potential Customers Are Developed	Average Retail Value of Vacuum Cleaners	Total Value of Potential Customers as Buyers of Vacuum Cleaners	Average Number of Hours in Service per Year per Vacuum Cleaner	Total Number of Service-Hours per Year	Service Cost per Hour (Based on 10 Cents per Kw.-hr.), Cents	Added Revenue to Central Stations from Sale of Energy	Total Value of Potential Customers as Purchasers and Users of Vacuum Cleaners
United States	8,175,510	440	4,528,005	$50.00	$226,400,250	300	1,358,401,500	1.75	$23,772,027	$250,172,276
New England	1,634,680	670	1,095,236	50.00	54,761,800	300	328,570,800	1.75	5,749,989	60,511,789
Middle Atlantic	2,571,330	695	1,787,074	50.00	89,353,700	300	536,122,200	1.75	9,382,139	98,735,839
South Atlantic	298,000	163	48,574	50.00	2,428,700	300	14,572,200	1.75	255,014	2,683,714
East North Central	1,771,160	513	908,605	50.00	45,430,250	300	272,581,500	1.75	4,770,176	50,200,426
West North Central	1,080,240	370	399,688	50.00	19,984,400	300	119,906,400	1.75	2,098,362	22,082,762
East South Central	239,000	44	10,516	50.00	525,800	300	3,154,800	1.75	55,209	581,009
West South Central	251,000	145	36,395	50.00	1,819,750	300	10,918,500	1.75	191,074	2,010,823
Mountain	90,100	570	51,357	50.00	2,567,850	300	15,407,100	1.75	269,624	2,837,474
Pacific	240,000	794	190,560	50.00	9,528,000	300	57,168,000	1.75	1,000,440	10,528,440

Table II—Value, When Wired, of Unwired Homes and Commercial Establishments Within Reach of Central-Station Lines as Probable Purchasers and Users of Electric Fans

Section	Number of Potential Domestic and Commercial Lighting Customers (Not Including Present Customers)	Probable Number of Fans per 1,000 Customers	Total Probable Number of Fans Sold if Potential Customers Are Developed	Average Retail Price of Fans	Total Value of Potential Customers as Buyers of Fans	Average Number of Hours in Service per Year per Fan	Total Number of Service-Hours per Year	Service Cost per Hour (Based on 10 Cents per Kw.-hr.), Cents	Added Revenue to Central Stations from Sale of Energy	Total Value of Potential Customers as Purchasers and Users of Fans
United States	9,697,248	370	2,999,934	$20	$59,998,680	154	462,139,200	0.75	$3,541,043	$63,539,723
New England	1,782,460	260	463,320	20	9,266,400	100	46,332,000	0.75	422,490	9,688,890
Middle Atlantic	3,158,788	294	928,683	20	18,573,660	150	139,302,450	0.75	1,044,768	19,618,428
South Atlantic	356,000	171	60,876	20	1,217,520	250	15,219,000	0.75	114,143	1,331,663
East North Central	2,120,000	270	572,400	20	11,448,000	150	85,860,000	0.75	643,950	12,091,950
West North Central	1,296,000	403	522,288	20	10,445,760	150	78,343,200	0.75	587,574	11,033,334
East South Central	287,000	170	48,790	20	975,800	250	12,197,500	0.75	91,481	1,067,281
West South Central	301,000	497	149,597	20	2,991,940	250	37,399,250	0.75	280,494	3,272,434
Mountain	108,000	613	66,204	20	1,324,080	150	9,930,600	0.75	74,479	1,398,559
Pacific	288,000	652	187,776	20	3,755,520	200	37,555,200	0.75	281,664	4,037,184

Table III—Value, When Wired, of Unwired Homes Within Reach of Central-Station Lines as Probable Purchasers and Users of Electric Washing Machines

Section	Number of Potential Domestic Lighting Customers (Not Including Present Customers)	Probable Number of Washing Machines per 1,000 Customers	Total Probable Number of Washing Machines Sold if Potential Customers Are Developed	Average Retail Price of Washing Machines	Total Value of Potential Customers as Buyers of Washing Machines	Average Number of Hours in Service per Year per Washing Machine	Total Number of Service-Hours per Year	Service Cost per Hour (Based on 4 Cents per Kw.-hr.), Cents	Added Revenue to Central Stations from Sale of Energy	Total Value of Potential Customers as Purchasers and Users of Washing Machines
United States	8,175,510	295	2,617,25-	$125	$327,252,100	85	222,447,015	3.00	$6,673,411	$333,925,510
New England	1,634,680	182	297,512	125	37,189,000	85	25,288,520	3.00	758,656	37,947,655
Middle Atlantic	2,571,330	312	802,255	125	100,281,875	85	68,191,675	3.00	2,045,750	102,327,625
South Atlantic	298,000	57	16,986	125	2,123,250	85	1,443,810	3.00	43,314	2,166,564
East North Central	1,771,160	473	837,000	125	104,719,750	85	71,125,000	3.00	2,133,750	106,853,500
West North Central	1,080,240	396	427,775	125	53,471,875	85	36,360,875	3.00	1,090,826	54,562,701
East South Central	239,000	26	6,214	125	776,750	85	528,190	3.00	15,846	792,596
West South Central	251,000	254	63,754	125	7,969,250	85	5,419,090	3.00	162,573	8,131,823
Mountain	90,100	428	38,563	125	4,820,350	85	3,277,855	3.00	98,336	4,918,686
Pacific	240,000	530	127,200	125	15,900,000	85	10,812,000	3.00	324,360	16,224,360

Table IV—Value, When Wired, of Unwired Homes Within Reach of Central-Station Lines as Probable Purchasers and Users of Electric Ranges

Section	Number of Potential Domestic Lighting Customers (Not Including Present Customers)	Probable Number of Electric Ranges per 1,000 Customers	Total Probable Number of Electric Ranges Sold if Potential Customers Are Developed	Average Retail Price of Electric Ranges	Total Value of Potential Customers as Buyers of Electric Ranges	Average Number of Hours in Service per Year per Electric Range	Total Number of Service-Hours per Year	Service Cost per Hour (Based on 4 Cents per Kw.-hr.), Cents	Added Revenue to Central Stations from Sale of Energy	Total Value of Potential Customers as Purchasers and Users of Electric Ranges
United States	8,175,510	16	56,515	$160	$9,042,336	1,100	64,166,500	5.00	$3,208,325	$12,250,661
New England	1,634,680	2	3,269	160	523,040	1,100	3,595,900	5.00	179,795	702,835
Middle Atlantic	2,571,330	2	5,142	160	822,720	1,100	5,656,200	5.00	282,810	1,105,530
South Atlantic	298,000	21	6,258	160	1,001,280	1,100	8,883,800	5.00	444,190	1,445,470
East North Central	1,771,160	3	5,313	160	850,080	1,100	5,844,300	5.00	292,215	1,142,295
West North Central	1,080,240	15	16,200	160	2,592,000	1,100	17,820,000	5.00	891,000	3,483,000
East South Central	239,000	12	2,868	160	458,880	1,100	3,154,800	5.00	157,740	616,620
West South Central	251,000	22	5,522	160	883,520	1,100	6,074,200	5.00	303,710	1,187,230
Mountain	90,100	26	2,343	160	374,816	1,100	2,577,300	5.00	128,865	503,681
Pacific	240,000	40	9,600	160	1,536,000	1,100	10,560,000	5.00	528,000	2,064,000

cleaners when they are served with central-station energy. This is based on the estimate that at the present time on the average 440 out of every 1,000 central-station customers own and use vacuum cleaners. The total retail value of these vacuum cleaners purchased by the new central-station customers is placed at $226,400,250, which sum is exceeded only by the amount which it is estimated these potential customers will pay for washing machines. It is estimated that these vacuum cleaners will represent 1,358,401,500 service-hours to the central station, or at the rate of 1.75 cents per hour, a total additional revenue to the central station of $23,772,027, a sum equal to almost 2 per cent of the total central-station gross revenue for 1923.

Washing machines, although in use at the present time on an average by only 295 out of every 1,000 central-station customers, are sold at about two and a half times the retail rate charged for vacuum cleaners, and the value of the washing machines sold to these prospective customers, $327,252,100, far exceeds the value of the vacuum cleaners sold as given above. The revenue which will be received by the central station from the use of washing machines, however, is only one-quarter that which will come from the use of vacuum cleaners, although the average service cost is 3 cents per hour for washing machines as against 1.75 cents per hour for vacuum cleaners.

In estimating the increased sale of fans from the development of these potential central-station customers it is necessary to include the potential commercial lighting customers as well as the potential domestic lighting customers. There are within reach of central-station lines 9,697,248 potential domestic and commercial central-station customers in the country who have not yet been developed. If these potential customers were developed almost three million fans would be purchased by them, representing an investment by the new customers of $59,998,680. On account of the seasonal use of fans and the low service cost per hour, the revenue to the central station from the use of these fans would be low, amounting to only $3,541,043.

Electric ranges and sewing machines are two other very popular instrumentalities in the lightening of household duties.

Table V—Value, When Wired, of Unwired Homes Within Reach of Central-Station Lines as Probable Purchasers and Users of Electric Ironing Machines

Sections	Estimated Number of Potential Domestic Lighting Customers (Not Including Present Customers)	Probable Number of Ironing Machines per 1,000 Customers	Total Probable Number of Ironing Machines Sold if Potential Customers Are Developed	Average Retail Price of Ironing Machines	Total Value of Potential Customers as Buyers of Ironing Machines	Average Number of Hours in Service per Year per Ironing Machine	Total Number of Service-Hours per Year	Service Cost per Hour (Based on 10 Cents per Kw.-hr.), Cents	Added Revenue to Central Stations From Sale of Energy	Total Value of Potential Customers as Purchasers and Users of Ironing Machines
United States	8,175,510	12	120,249	$120	$14,429,880	150	18,047,350	4.00	$735,894	$15,165,774
New England	1,634,680	7	11,443	120	1,373,160	150	1,716,450	4.00	82,658	1,455,818
Middle Atlantic	2,571,330	17	43,713	120	5,245,560	150	6,556,950	4.00	262,278	5,507,838
South Atlantic	298,000	4	1,192	120	143,040	150	178,800	4.00	7,152	150,192
East North Central	1,771,160	19	33,652	120	4,038,240	150	5,057,800	4.00	202,312	4,240,552
West North Central	1,080,240	21	22,685	120	2,722,200	150	3,402,750	4.00	136,110	2,858,310
East South Central	239,000	3	717	120	86,040	150	107,550	4.00	4,302	90,342
West South Central	251,000	6	1,506	120	180,720	150	225,900	4.00	9,036	189,756
Mountain	90,100	14	1,261	120	151,320	150	189,150	4.00	7,566	158,886
Pacific	240,000	17	4,080	120	489,600	150	612,000	4.00	24,480	514,080

Table VI—Value, When Wired, of Unwired Homes Within Reach of Central-Station Lines as Probable Purchasers and Users of Electric Dishwashers

Sections	Number of Potential Domestic Lighting Customers (Not Including Present Customers)	Probable Number of Dish-Washers per 1,000 Customers	Total Probable Number of Dishwashers Sold if Potential Customers Are Developed	Average Retail Price of Dish-Washers	Total Value of Potential Customers as Buyers of Dish-Washers	Average Number of Hours in Service per Year per Dish-Washers	Total Number of Service-Hours per Year	Service Cost per Hour (Based on 10 Cents per Kw.-hr.), Cents	Added Revenue to Central Stations From Sale of Energy	Total Value of Potential Customers as Purchasers and Users of Dish-Washers
United States	8,175,510	11	100,057	$100	$10,005,600	360	36,019,520	2.5	$901,388	$10,906,988
New England	1,634,680	8	13,077	100	1,307,700	360	4,706,720	2.5	117,668	1,425,368
Middle Atlantic	2,571,330	18	46,284	100	4,628,400	360	16,662,240	2.5	416,556	5,044,956
South Atlantic	298,000	4	1,192	100	119,200	360	429,120	2.5	11,628	130,828
East North Central	1,771,160	12	21,254	100	2,125,400	360	7,651,440	2.5	191,286	2,316,686
West North Central	1,080,240	8	8,641	100	864,000	360	3,110,760	2.5	77,769	941,769
East South Central	239,000	2	478	100	47,800	360	172,080	2.5	4,302	52,102
West South Central	251,000	9	2,259	100	225,900	360	813,240	2.5	20,331	246,231
Mountain	90,100	15	1,352	100	135,200	360	486,720	2.5	12,168	147,368
Pacific	240,000	23	5,520	100	552,000	360	1,987,200	2.5	49,680	601,680

Table VII—Value, When Wired, of Unwired Homes Within Reach of Central-Station Lines as Probable Purchasers and Users of Electric Sewing Machines

Sections	Number of Potential Domestic Lighting Customers (Not Including Present Customers)	Probable Number of Sewing Machines per 1,000 Customers	Total Probable Number of Electric Sewing Machines Sold if Potential Customers Are Developed	Average Retail Value of Electric Sewing Machines	Total Value of Potential Customers as Buyers of Sewing Machines	Average Number of Hours in Service per Year per Sewing Machine	Total Number of Service-Hours per Year	Service Cost per Hour (Based on 10 Cents per Kw.-hr.), Cents	Added Revenue to Central Stations From Sale of Energy	Total Value of Potential Customers as Purchasers and Users of Sewing Machines
United States	8,175,510	48	310,961	$70	$21,767,270	260	80,849,860	0.75	$606,373	$22,373,643
New England	1,634,680	26	42,502	70	2,975,140	260	11,050,520	0.75	82,879	3,058,019
Middle Atlantic	2,571,330	28	71,997	70	5,039,790	260	18,719,220	0.75	140,394	5,180,184
South Atlantic	298,000	51	15,198	70	1,063,860	260	3,951,480	0.75	29,636	1,093,496
East North Central	1,771,160	52	92,100	70	6,447,000	260	23,946,000	0.75	179,595	6,626,595
West North Central	1,080,240	35	37,800	70	2,646,000	260	9,828,000	0.75	73,710	2,719,710
East South Central	239,000	22	8,365	70	585,550	260	2,174,900	0.75	16,312	601,862
West South Central	251,000	52	13,052	70	913,640	260	3,393,520	0.75	25,451	939,091
Mountain	90,100	66	5,947	70	416,290	260	1,546,220	0.75	11,596	427,886
Pacific	240,000	100	24,000	70	1,680,000	260	6,240,000	0.75	46,800	1,726,800

Healthy Increase in Electrical Export Trade During 1923

Improved World Business Conditions Offer Optimistic Viewpoint to Manufacturers of Electrical Machinery and Equipment—Trade with Various Foreign Countries During 1923 Reviewed

By R. A. Lundquist
Chief of the Electrical Equipment Division
United States Bureau of Foreign and Domestic Commerce

SHOWING a healthy increase over 1922, the foreign business of American electrical manufacturers has been satisfactorily maintained during the past year. Not only does this statement apply to the total for the year, but to the month-by-month figures as well, which have shown a well-sustained steadiness. At the same time also there has been a good domestic demand for electrical goods, which to some extent has tended to lessen the aggressiveness of manufacturers in foreign fields.

Definite returns have not yet been issued for the full year 1923, but on the basis of the data for the first ten months it may be safely estimated that our exports of all classes of electrical goods will approximate $70,000,000, or about $7,000,000 more than for the year 1922. In the apparatus field generating equipment has shown a fair gain, while transformer exports have decreased, the figures for ten months of 1922 and 1923 being $3,596,574 and $2,413,562 respectively. A net increase over 1922 is shown for motors, large gains being made in small-motor classes, especially in the fractional-horsepower sizes. There was little change in the exports of motors over 200 hp. as compared with the preceding year. Motor-control equipment, however, showed a considerable increase as compared with the preceding year.

Railway Electrification Largely Increases Exportation of Electric Locomotives

Several railway electrification contracts obtained by American manufacturers in 1922 resulted in large increases in the exportation of electric locomotives during 1923. Mine and industrial locomotives ran approximately the same as in 1922.

While conditions in the domestic market during 1923 were not favorable to self-contained lighting outfits, exports of such sets were considerably ahead of those for 1922, shipments for the first ten months of 1923 being 1,955, valued at $535,378, compared with 1,233, valued at $381,575, during the same period of 1922.

Interest in radio and a good automobile business abroad during 1923 resulted in a notable gain for storage-battery exports. Primary batteries showed a gain as compared with the previous year, which may also be ascribed in part to radio. The value of flashlamps shipped abroad during 1923 was at least double that of 1922.

Electric appliance lines have shown consistent strength throughout the year. While exports of fans were little above those during 1922, shipments of motor-driven household devices and of domestic heating and cooking appliances during 1923 were much greater than during the preceding year. The trend in these latter lines is good in most markets.

Comparable figures for telephone exports are difficult to segregate, owing to a change in classification, but exports were lower than during 1922, foreign orders shipped from American-owned branch plants in Canada being apparently a factor in this. Telegraph apparatus exports showed a considerable gain over 1922. Radio and wireless apparatus shipments continued to grow in importance, it being estimated that the total exports for the year were in the neighborhood of $3,040,000 as compared with $2,879,799 for 1922.

Incandescent-lamp exports were slightly lower than during 1922, as is to be expected in view of the tendency toward local factories in markets to which lamps were formerly shipped from this country.

The export classes comprising wiring devices, conduit and fittings and fixtures showed a very considerable gain over the preceding year and apparently represented the result of more aggressive selling activity on the part of manufacturers of such lines. A gain in the class "sockets, receptacles and lighting switches" is especially noteworthy, the actual exports for the first ten months of 1923 being valued at $902,124 as compared with $358,255 for 1922. Exports of insulated copper wire and cable reflected the gains in the foreign business in wiring devices generally and amounted to $2,675,674 for the first ten months of the year as compared with $1,628,576 for the same period of the preceding year. Bare copper wire showed no great change from the previous year, but there was a good gain made in insulated iron and steel wire.

Business conditions throughout the world, with the exception of certain parts of Europe, are at the present time more satisfactory from the viewpoint of electrical manufacturers than they were a year ago, and a continuance of optimism concerning foreign electrical trade appears to be justified. To some extent this is a result of improved economic conditions, but taking the world as a whole, a rising standard of living abroad generally must also be credited with increasing the demand for all classes of electrical goods.

Our greatest volume of electrical exports went to North American territory, and Canada, of course, continued as the largest customer in these nearby fields, though there was good improvement in both Cuba and Mexico. In the former, radio business was a very important factor and was one of the largest items of electrical export to that country. However, there was shown a well balanced demand in Cuba for all classes of

electrical goods. More stable conditions in Mexico undoubtedly brought about the improvement in that market. The volume of business was in lighting equipment and materials, rather than power apparatus, but there was a uniform gain generally in all classes of electrical goods.

Though failing to maintain its position of 1922 on the showing of statistics compiled to date, Asia continued as a large buyer of American electrical goods, with Japan taking a very heavy percentage of the total, as has been true in the past. The recent disaster in Japan affected the export situation during the late months of the year only to a limited extent, but it undoubtedly will be more apparent during 1924.

The volume of exports during 1923 of large generators, transformers, switchboard equipment, switchgear, lightning arresters and the like was to be expected in view of the activity shown by Japanese interests in continuing the development of the water-power resources of the country. The heavy importation of motors of from 1 to 200 hp. and of insulated wire and cable is interesting as indicating that business can be done in those lines in Japan in spite of the large local production of such apparatus and material. Shipments of electric household appliances and heating devices during the year, while small, are worthy of comment as indicating that such lines can be sold to some extent even in those markets where servants are inexpensive.

China and India maintained about the same activity as during 1922, but it may be expected that the latter country will present a better market during 1924, in view of the new policy of making purchases locally instead of in London, to a far greater extent than has been customary. More aggressive activity in India is well worth while.

Our exports to South America show an increase over the preceding year, with Argentina, Brazil and Chile, of course, in the lead. In Argentina the volume of business appears to have been done in communications equipment and lines accessory to it, radio again being a heavy item. In Brazil insulated wire and cable was one of the most important items, radio business with that country being negligible on account of restrictions imposed by the government. Chile shows a considerable gain over 1922, a result principally of the large electrification contract being carried out there by an American manufacturer.

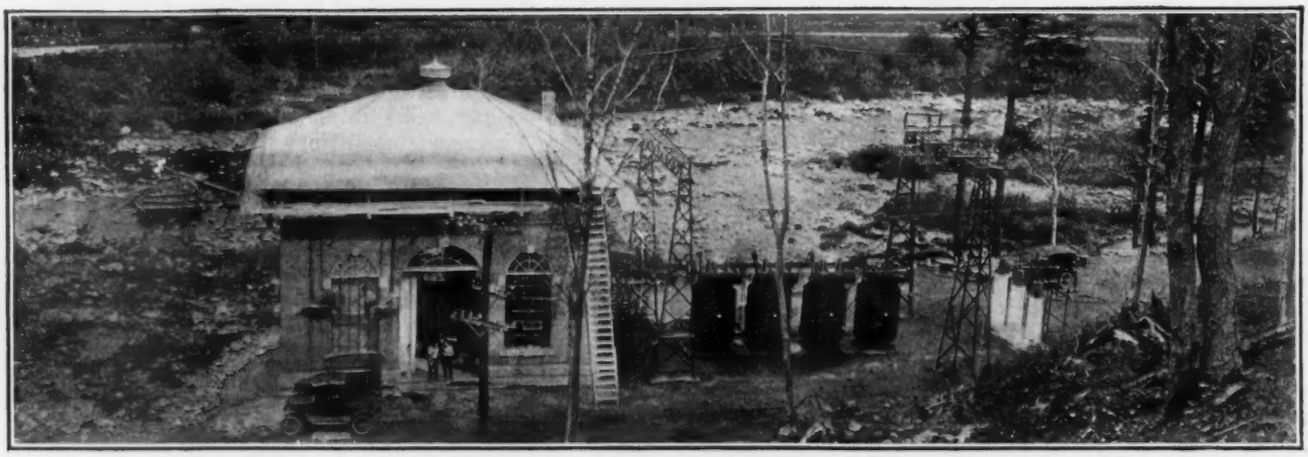
In the European territory Great Britain was naturally our most important customer for electrical goods, and the business done was largely in appliances, lighting supplies, batteries and similar lines, though it is interesting to note that a large quantity of insulated copper wire and cable was exported to Great Britain as well as a considerable number of fractional-horsepower motors and a fair number of farm-lighting sets. Not a little radio business was also done, principally in parts that were not affected by the restrictions imposed by the Postmaster-General. France and Spain rank next in importance in the European market, each taking considerably more electrical goods than during 1922. The increased business in France was in power equipment and material, a result of the activity shown in that country in developing large power-transmission systems. Radio exports to France were quite small. Railway locomotives were a large item of export to Spain, with insulated wire, railway signals, transformers, storage batteries and home lighting sets also of prime importance. Noteworthy also in the Europeon market were Italy and Belgium, the former taking large quantities of electrical carbon products, while electrical household appliances and heating devices were the more special features of the electrical imports of Belgium from this country.

In Oceania, Australia was naturally the largest market, though our exports to that country did not more than maintain their strength. Telephone equipment, motors of from 1 hp. to 200 hp., switchboards, switches and circuit breakers and electrical household appliances were the most important items. Storage batteries, home lighting sets, wiring devices and radio material were also exported in good quantities.

Exports of New Zealand were well maintained as compared with the previous year and reflected the power-transmission system development that is going on in that country. Porcelain insulators were the largest item of shipment from this country, with motors, batteries, transformers and switchgear comprising the more important other items. Considering the present development of the market the radio business was very good.

While a certain amount of electrical business was done with most of the European territories in Africa, by far the most important market was British South Africa, to which storage batteries, motors, domestic heating appliances and incandescent lamps were the more important items of export.

Increased Use of Automatic Stations, Substations and Control



Automatic hydro-electric stations have proved valuable in reducing production costs

Commercial Trends of 1923 and the Future Outlook

Closer Association of Public Relations with Sales Departments, Selective Study for More Intensive and Intelligent Load Building and Merchandising for Profit Are Most Notable Developments

LOOKING across the panorama of the year just gone and the immediate prospect of 1924, three things stand out in the consideration of commercial trends in the central-station industry. There is undoubtedly a new bond developing between public relations and the sales function that is fast correcting the drift toward separation that had set in. It has come because executives earnest in the cause of good public relations are beginning to appreciate that, after all, this is a natural function of sales and an ideal impossible of fulfillment without active creative support from the sales department. Salesmen also are thinking more of these broad purposes and responsibilities. This tendency promises great benefits to come.

Then, also, a new viewpoint is receiving expression here and there throughout the industry in the matter of merchandising policy and the relationship between the utility and the local electrical family. A clearer conception seems to be coming that appliances as well as energy must be sold at a price that covers all costs and pays a just profit.

In line with the spirit of this there is evidenced, too, a more serious regard for the opportunity which has been too long ignored to make a practical analysis of the comparative values of loads and to select for intensive development the kinds of business that offer the highest profit per kilowatt and have other desirable characteristics.

These are all very fundamental objectives and will be important influences in shaping the trend in central-station selling this year and in the years directly ahead. Meanwhile, notable progress has been made in the field of power and also in the development of lighting. Some of the high lights of this prospect are pictured in the six following pages, written by a few upstanding men who have been in particularly good positions to observe conditions clearly.

Public Relations Require More Light Within the Industry

BY H. T. SANDS
Charles H. Tenney & Company, Boston;
Chairman Public Relations National Section, N. E. L. A.

PUBLC relations have received careful consideration at the hands of the electric light and power industry during the past year as evidenced by the prominence given the subject in the programs of national and geographic division conventions; but, gratifying as this self-evident fact is, the outstanding feature of the work of the past year has been the analyzing of the term itself in an effort to understand more clearly its real meaning and purpose.

As a result of the analysis we are beginning to understand that good public relations are not something to be spasmodically taken up when a utility is subjected to any public attack, but, rather, something to be carefully and consistently pursued, day in and day out, throughout the year; that they are not a panacea to be invoked in time of trouble, but, rather, the preventive medicine the continual application of which will keep our industry in a sound and healthy condition.

We are also realizing that adequate service, reasonable rates and courteous treatment—although important and vital—are not in themselves sufficient to maintain right public relations; that if we would win from the public the fullest measure of its confidence and trust, the industry must see that the public receives at first hand such information regarding the fundamentals of our business as will enable it to accord intelligently that confidence and trust.

We are seeing more clearly than ever before that the first and fundamental step in acquainting the public with the problems of our industry is in the education of our own employees. We have spent a great deal of time, energy and money in educating our employees along accounting, commercial and technical lines, but have apparently taken it for granted that there was no need for education in the fundamentals of the industry, with the result that today a large majority of our own employees are but little better informed as to the fundamentals of the public utility industry than the great mass of the public served.

Personal Service by Individual Employee Is Solution of Good-Will Problem

BY S. M. KENNEDY
Vice-president in Charge of Business Development and Public Relations, Southern California Edison Company, Los Angeles

IT SEEMS to me that the principal progress to be recorded is the nation-wide awakening among utility executives to the necessity of constructive work to establish a more careful contact between utilities and their customers and the general public. In the past there has existed in the minds of some executives an idea that all that need be done was to have a board of directors pass resolutions concerning the board's desire as to how public relations should be handled and then spread the information regarding these resolutions to their organization, expecting that thereafter everything would be harmonious as between the company and its customers. Much to the surprise of some executives, these resolutions or good intentions were found to be impotent and ineffectual, and they have had gradually to realize that other methods, calling for more personal effort, must be adopted.

The outstanding feature for 1923 is the more complete realization that the question of public relations is one that requires careful study and conscientious work

in order to meet local requirements and improve conditions as far as public contacts are concerned.

It is doubtful if any better methods have been discovered and adopted during 1923 than those which have been heretofore available. There are three principal points of contact through which public relations may be improved. No matter how good the public relations may be with any organization, they can always be made better. The first point of contact is letter writing; the second, business transacted over the telephone, and the third, the personal contact.

The intercourse over telephones is in any business organization becoming a greater factor almost every day, and in many organizations this point of contact has been largely overlooked and its importance unappreciated. The personal contact between officers and employees of a utility company and the public is, of course, the chief point. Improvement in this direction can only be brought about by education of employees to the advantages and necessities of courteous consideration in every transaction which the utility company has with its customers and the general public.

There are two stages in connection with establishing and improving public relations, namely, the planning and the executing. The year 1923 has been to a great extent a planning year. Many committees have been formed, many discussions have taken place, many ideas have been suggested, and it is hoped many practical plans have been formed. The coming year should see these plans put into execution so that the public may realize that utility companies are in earnest when they announce publicly that an improved condition is desired and that the public utility organizations have machinery in operation in order to bring about better conditions.

I feel that we are getting ahead, but we have a great deal to do. The dangerous feature up to now in the attempt to improve public relations has been that the various committees dealing with this subject are liable to make a complex situation out of something which is in reality very simple. Good will comes from courteous and friendly contact. The great thought is to get the idea into the minds of employees so that they will involuntarily be courteous and considerate at all times. There is nothing else to it. If this simple side of the matter is taken care of, then the complex problem of public relations is solved. It is up to the individual officer and employee to do his or her share in pleasing the individuals with whom they come in contact.

Profit Lies in Intensive Development of Territory Now Served

BY G. M. GADSBY
Vice-President West Penn Power Company, Pittsburgh

REVIEWING the progress made in central-station commercial development and policy during 1923 in the light of our own experience, there are two outstanding features—first, the ability to sell central-station service to power consumers requiring large capacity and operating at rather high load factor; second, the results that can be obtained by intensive work for lighting consumers in communities which have had service for many years. These two features are almost at the extremes of selling experience.

In spite of the elimination of competition between public utilities in a prescribed territory which has wisely been brought about by commission regulation, the sale of our service in large blocks has been sharply competitive. With the additional investment required for transforming and transmitting energy from its point of generation to its point of use, there has not been a wide "spread" between the cost of central-station power and the cost of the isolated plant when the isolated plant has been fortunately located with reference to water and fuel supplies.

The past year has seen a perceptible advance in this class of business. Not only have several rather large contracts been secured, but keen interest has been displayed on the part of some of the greatest users of power in the Pittsburgh district. During the latter part of the year this has led into another very interesting development—that of the establishment of connections with large industries in which the production of power is by way of being a byproduct, with an arrangement for the supply of power requirements, beyond that classified as byproduct, by the utility and the taking away for the industry of surplus energy during off-peak periods. Arrangements of this character have been in operation for a considerable period, but there has been a general interest displayed during the past few months which opens great possibilities for development in the coming years. I feel that these conditions are in part due to the development of protective equipment and the installation of apparatus by the central stations which improve continuity of service with regard both to voltage and to total interruptions.

As regards the second feature of increasing lighting business in communities which have been served for some time, a rather surprising state of affairs has been disclosed in that with equal effort in various communities it has been found that as much can be expected in the way of growth in those sections which have been considered as having reached the average "saturation point" as in newer communities into which service has been brought after the community has developed and in which therefore the proportionate number of unwired houses is much greater. By conducting intensive campaigns throughout the year, using specially trained crews, almost twice as many new connections have been added to the lines as in any preceding year.

Looking forward to next year, I believe that while business conditions generally are favorable, there will be sharper competition and consequent closer scrutiny of production costs among power users. The reaction from this is twofold—first, it offers opportunity to sell central-station service on the grounds of greater operating efficiency; second, it requires close co-operation with present consumers so that the greatest amount of service may be obtained for the amount paid for power. This can be accomplished by increasing load factor and the changing or elimination of equipment which, owing to conditions of service, may bring about charges that can be mitigated or entirely avoided.

Looking to the longer future, it would appear that progress should be made in the standardization of power schedules among the utility companies and in continued effort for the simplification of all schedules. The development of "superpower" and interconnections between various company systems will accentuate the necessity for this standardization because of the tendency toward the leveling of production costs that these agencies will bring.

Past Experiences Are Evolving Sound Commercial Policies

BY NORMAN T. WILCOX
Stone & Webster, Inc., Boston;
Chairman National Commercial Section, N. E. L. A.

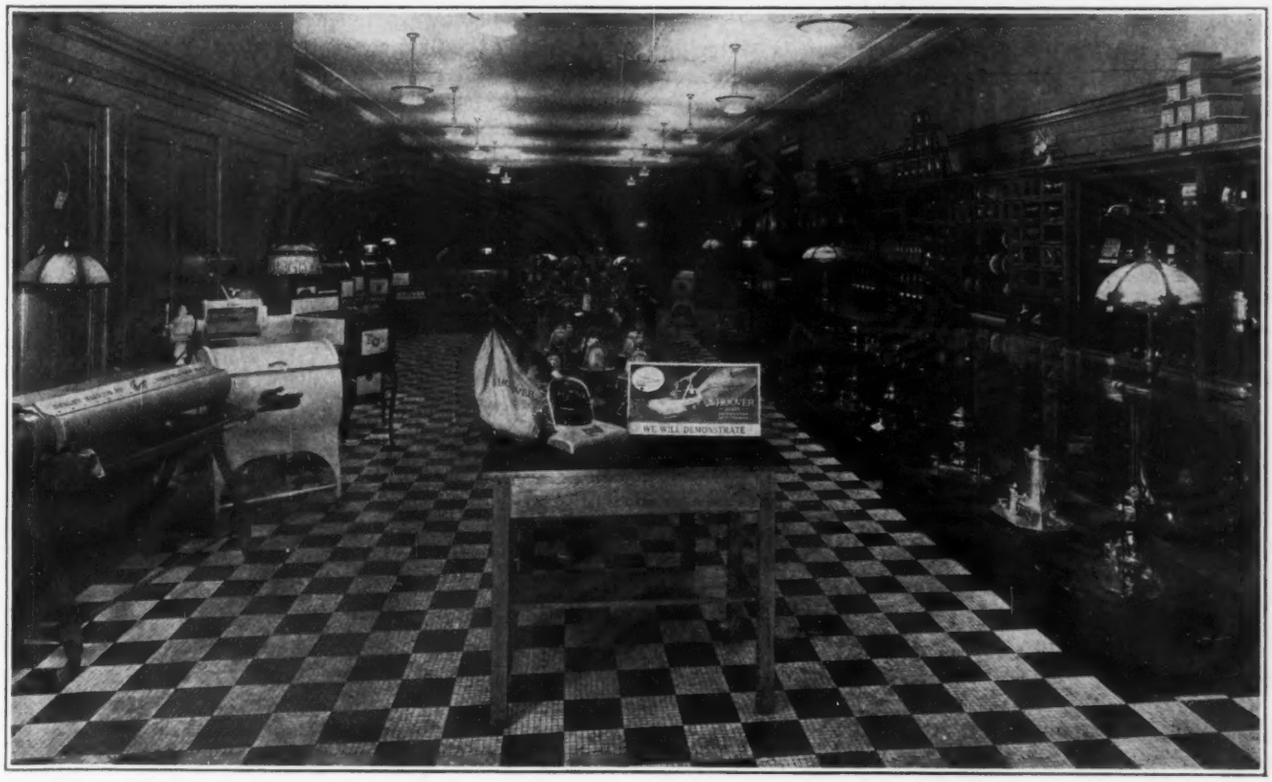
COMMERCIAL expansion in the central-station industry during the last year has been marked by several outstanding developments: The awakened and needed interest in commercial problems which has been apparent especially during the last two years is resulting in much more definite and concrete ideas as to what is needed. Executives have felt the growing need but are now showing more definite interest than ever. Notable and successful demonstrations of sound commercial policy and practices, such as have been evidenced by the aggressive work at Cincinnati, especially in the house-wiring campaign, have demonstrated that the central station *must* lead and not wait for others to do its own peculiar work. The recent southern California range campaign and the excellent merchandise work in the Wichita district, as well as others, might also be cited.

These developments clearly indicate that the central station with an up-to-date and aggressive commercial and development policy, coupled with fair, "live and let live" prices (contrary to the ideas of the average contractor), is justified in aggressive merchandising effort. These and other examples demonstrate that not only does the central station increase its sales of both appliances and energy many times, but at the same time that the contractor's sales are several times increased over previous figures. Fair competition spells success for all as well as that adequate service desired by the public.

Aside from wiring and sales of motors, lamps and supply materials, the distinction between ordinary shelf electric merchandise and the promotional devices is becoming more marked. Four-fifths of the very large possible increase of residential service will result from proper demonstration of the promotional devices, such as electric fireless cooker stove, electric range, refrigerator, water heater, and so forth.

Many companies are now developing or seriously considering the development of suitable sales organizations and personnel competent both to introduce and properly follow up these developments. The year 1924 will show that we are beginning to profit by past experiences and that we are now better appreciating both the needs and the wonderful possibilities ahead. Although an average of $50 annual increase per customer in residence service and two to three dollars per annum sales of central-station merchandise per capita may seem large, it is my belief that this expectation is not so unreasonable as some people may think.

Adding to this the large possibilities of development of industrial loads, doubling of street lighting and similar increases in commercial lighting, the central stations themselves, as well as those making apparatus and supplies, may well look forward with pleasant anticipation to the further and progressive development of central-station service.



THIS RECENTLY COMPLETED SALESROOM OF THE KNOXVILLE (TENN.) POWER & LIGHT COMPANY IS TYPICAL OF MODERN PRACTICE IN APPLIANCE DEMONSTRATION AND MERCHANDISING

Central-station companies have a very definite responsibility in keeping a watchful eye upon the quality of electrical devices being sold to their customers, and salesrooms like that pictured above are a most practical means of educating the public in the value and merits of the various appliances. Customers, especially women, coming in to pay their bills frequently linger to inspect some piece of merchandise, and whether they buy from the company or some other dealer the seed of desire to possess has been sown. Central stations, in justice to their customers from a service standpoint and to their stockholders from a revenue standpoint, can ill afford to neglect being authoritative headquarters for everything electrical.

Electric Heating Applications Call for Closer Study and Attention

BY V. M. F. TALLMAN
Charles H. Tenney & Company, Boston
Chairman Power Bureau, N. E. L. A.

ASIDE from the fact that during the last few years conditions have made it much easier to obtain power business, very little progress has been made among the smaller and medium-size companies in the systematic study of how to sell power except through the N. E. L. A. study courses. Power men generally appear to be so tied up in detail that they scarcely have time either to get out into broader activities or even to keep posted on current developments, let alone having the time available to investigate new fields of application.

The question of power-factor control is entering more prominently into all of the commercial power man's negotiations, and some headway has been made. So long, however, as installations are made by those who do not have at heart the utility's power-factor problem, we shall probably be confronted with low-power-factor conditions in many of our industrial loads. Synchronous-motor manufacturers are helping to keep this subject in the foreground by their advertising, and rates are gradually being supplemented with power-factor penalty clauses which, ultimately, will make it necessary for large customers at least to improve their motor equipment.

I believe we are getting ahead with small industrial power applications for existing power users—rather slowly, however. Some of this is being done through the manufacturers' efforts and some through the central station. The average central station, however, does not seem to be alive to the opportunity presented by the heating load, neither has it the personnel actively to develop and get business. The men selling heating applications must be very well trained and should recognize the limitations of electricity.

Compensation for expensive construction to connect large customers is coming to be looked on with disfavor by some companies and commissions and only in exceptional cases are customers required to advance part of the cost of extensions.

Training of men takes time and costs something, and commercial men have not yet "sold" their executives on this subject. I believe we are making good progress, however, through the heating division of the N. E. L. A., and within another year the executives will probably receive information based on actual facts which will let them see that the heating business is an excellent revenue producer.

The general situation seems to be improving. Private plants that have been holding off are closing with utilities for the supply of power, and large corporations have adopted the policy that it is better to purchase central-station power than to endeavor to continue with their own plants. The labor situation in some districts is unsettled (leather) and in others very favorable (granite). The power sales for fourteen companies, first ten months of 1923, are 13 per cent higher than for the corresponding ten months of 1922. It seems, too, that the commercial departments of the utilities should expand a little so that their men may get better training, have a little more time for intelligent, systematic study, for contact with the others in the industry, and for more intensive calling on customers and "prospects," to the end that relations with the customer may be more personal, with the result which always follows—satisfied customers and a prosperous utility.

Need Is Now Urgent for Selective Study of Load Development

BY A VICE-PRESIDENT AND GENERAL MANAGER OF A LARGE CENTRAL-STATION COMPANY

POWER-LOAD development at the present time is so rapid that it is keeping the utilities all busy in providing the extra capacity necessary to carry the load as it comes to them. New factories installing their own power plants are indeed a rarity. They turn for power, from the first conception of their proposition, to the utility. Older manufacturers are continuing to drop their private power plants and go to the utility. Today many of the utilities have a tremendous power load, with the result that their period of maximum load is through the daylight hours and possibly the early evening. This situation is so marked and so generally established in industrial centers that it would seem to be only a question of time until very strong efforts will have to be made to find out if there is not some available load which can be picked up through the night hours.

A great deal of progress has been made in the study of power and how to sell it. Practically every power company has now on its commercial rolls from one to a dozen or more men technically trained and experienced who can properly be termed commercial engineers—men having the ability to analyze and adjust power-production costs in the operation of the isolated plant mechanically or electrically and to make extremely close estimates of the cost of central-station electrification of such plants. This work brings these men into contact with all sorts of manufacturing operations and practically every form of machinery that can be driven by an electric motor. Of course, all of these men are not good. Some of them never will be. But the utility that is properly handled gradually gathers around it a number of men who average very high in their ability to sell power.

The idea of power-factor control is making headway. It is bound to make further headway. Plenty of cases can be found on any big system where the difference in cost of the consumer's wiring in his own property will practically equal, perhaps at times exceed, the cost of proper power-factor-correction methods. It is the power companies, however, that have got to bring this matter home to the power users. Both have much to gain—the power company from the greater capacity of its transformers, switches, transmission lines, and to an extent even of its generating apparatus; the consumer through lower cost of wiring, better regulation, and in general better service.

The general situation as regards the electric business and the possibilities of great advances in its scope never looked better. There are, of course, some indications of a slowing down of business conditions at the present time. The consensus of opinion, however, seems to be that on account of the limited amount of manufactured stock available of all kinds, this condition will not be maintained and that next year's business will be what we should all class as good.

Fair Competition and Co-operation Helps Develop Appliance Market

By W. W. Freeman
President Union Gas & Electric Company, Cincinnati

THE proper place of the central station in local retail markets is becoming pretty clearly defined. We have sincerely tried out different policies in Cincinnati in the past decade, and we are at least clear in our own minds that we are on the right track in this territory in pursuing a very aggressive policy of merchandising of electrical appliances directly to our consumers through our own merchandising department in fair competition and co-operation with the contractors and other merchandising agencies in the territory.

The number of appliance departments of the central-station companies that pay a profit is increasing, and I am of the opinion that all such departments should be operated upon a basis of reasonable merchandising profit. Proper salesmanship will produce substantially as large a volume of sales at a fair profit as would result from reliance upon special selling prices featured to force volume. The policy of selling at a fair profit furthermore serves to stimulate competing business on the part of contractors and other electrical interests in the territory, which is a necessary factor to good public relations.

I believe the outlook for electrical merchandising sales during the coming year to be exceedingly encouraging. There should continue to be cumulative results from past years' efforts with existing customers, and we see no indication of any curtailment in continued growth of business.

Appliance Merchandising Should Have More Profit for the Retailer

By John F. Gilchrist
Vice-President Commonwealth Edison Company, Chicago

PROGRESS has been made during 1923 in the study of policies in merchandising electric appliances. The interest grows. More of the central-station companies are beginning to recognize their responsibility in seeing that their customers have an opportunity to enjoy the advantages of electric appliances—advantages which many will die without obtaining if a more rapid way of getting a wider distribution is not found. Distribution will widen slowly until merchandising is put on a basis where a reasonable reward for their efforts is assured to those agencies essential to a wide distribution.

If by government edict no one could charge more than $300 for an automobile, $25 for a typewriter or $5 for a sewing machine or a lawn mower, some foolish people might hail with delight a condition where everybody could enjoy these devices, but the wise ones would know that these beneficial machines would quickly disappear. Now, while this is an exaggerated statement to emphasize a point, the electric appliance business is suffering from a situation which differs from the one described only in degree. The cause, instead of being a short-sighted government decree, is a short-sighted policy of marking goods at a widely advertised price which does not leave enough margin over cost to reward properly the effort necessary under existing conditions to a wide distribution of the goods.

That decided advantages accrue to all branches of the industry as a result of the central station being the leader of the community in electric merchandising activities is being recognized more and more. This is sound doctrine so long as its domination is under a policy of co-operation and mutual interest. Probably the number of appliance departments that pay a profit when considered from the standpoint of the cost which would prevail were the business an independent one will be fewer this year than ever. This is rather an encouraging situation and indicates growth, because under present conditions it is generally the case that drifting businesses with entirely inadequate distribution are the ones that show profits. As the pressure is put on to increase volume losses increase until a certain point is reached, when they turn the other way.

Notwithstanding the difficulties, great progress has been made in 1923. Management has been more intelligent, rate of turnover has been improved, "spreads" have been increased. The New Year should show more rapid progress, and with the promise of closer co-operation between the different branches of the industry in the effort to understand each other's problems and to help in clearing them up, the future of the appliance business is very bright.

Trade Relations and Discounts Paramount Merchandising Problems

By J. L. Harvey
Sales Manager Kansas Gas & Electric Company, Wichita, Kan.; Chairman Appliance Bureau, N. E. L. A.

THERE is a general trend among central-station companies, regardless of their former practice or affiliations, actively to sell merchandise to their customers. The policy is to sell at manufacturers' listed retail prices in accordance with other dealers' principles, whether they be electrical merchants or otherwise. One disturbing element which central-station managers are viewing with considerable uneasiness is the cheap class of merchandise being handled through drug stores, department stores and other non-electrical shops, not from the viewpoint of competition but because of the defective, unserviceable devices going into their customers' hands. To offset this some form of "tie-in" should be made with these various dealers in an effort to get them to raise the standard of their merchandise.

Without doubt the central-station company's place in the local retail market is becoming more clearly defined, and companies are more carefully considering the position thus gained with regard both to net earnings from the sale of merchandise and to holding the good will of other retail institutions, whether they handle electrical merchandise or not. In other words, central-station organizations are showing a marked tendency toward establishing themselves in such a way that their methods will be above reproach by other retail dealers, while at the same time they render an adequate and satisfactory service to customers and purchasers of merchandise.

This question of whether the central-station merchandising departments pay a profit is a serious one. If they are operated on a sound retail basis—that is, sell a complete electrical line at list prices and encourage others to do likewise—they should be more than self-supporting and earn a net profit. There is, however, one all-important factor to be considered, and that is the matter of discounts. A certain degree of im-

provement has been made in the amount of spread between the cost and selling prices of electrical appliances, but it is a well-known fact that discounts have been all too small to cover overhead expenses, to say nothing of the cost of missionary and pioneering work that has been necessary to introduce these devices. Manufacturers and jobbers should offer a margin ample to cover all costs of selling plus a reasonable profit, and if this margin is not sufficient to attract such merchants as the department stores, it should be no more attractive to the central-station company. The day is past when short discounts can be camouflaged in a smoke screen of data and statistics giving highly sanguine estimates of the energy consumption and revenue value of an appliance. A successful merchandising department must be conducted primarily for profit—increased revenue from energy used by the devices will follow as a natural consequence.

Indications are that the year 1924 will show the same improvement that 1923 has over 1922. This will be greatly accelerated if, as planned, the central-station companies themselves go into a thorough study of merchandising costs and methods based on actual operating data that are being compiled.

Efficient Merchandising Department Provides Best Contact with Customers

BY R. H. TILLMAN
Manager New Business Department, Consolidated Gas, Electric Light & Power Company of Baltimore

THE whole appliance field, as well as the policy in selling, is going through a stage of development. Undoubtedly the trend now is toward a larger merchandising business by the central-station companies. However, the progress made cannot be definitely determined, and comparisons are difficult because of the lack of uniformity in accounts as well as in methods of doing business in the various companies.

Those central-station companies which have established progressive merchandising policies and adopted properly subdivided accounts are showing encouraging growth. It is my belief that these companies have demonstrated that merchandising of appliances can be done on a profitable basis and in a merchandising manner. During the exploitation period the central-station companies were no doubt too much concerned about the revenue from appliances and believed that they could afford free distribution of appliances instead of proper merchandising. At the present time I believe many central-station companies are too little concerned with the increase in possible load by appliances and are thus not taking advantage of the increase in revenue and seeing that the sales organizations are doing their duty in the merchandising field.

Only recently have many of the central-station companies fully appreciated the opportunity afforded by merchandising methods in giving better service and thereby developing and maintaining good will through direct contact with their customers. They have learned that not only can increased revenue be obtained by the sale of quality appliances in quantity throughout their territories, but that the resulting constant contact with their customers gives them an opportunity to learn of poor service or complaints which otherwise would not be known until too late, when errors could not be corrected and better service given. Merchandising executives now realize that they must conduct this department upon high ideals and with the desire always to give service.

Central Stations More Interested in Electric Trucks—Industry Progressing

BY CHARLES R. SKINNER
Manager Automobile Bureau, New York Edison Company
Chairman Electric Transportation Bureau, N. E. L. A.

THE past year has developed a more favorable attitude by central stations toward the electric truck. They have done away to a large extent with the negative attitude heretofore shown when inquiries came to them from prospective users of electric trucks. The central stations during the past year have themselves purchased approximately 225 electric trucks for their own needs. This is a large increase over other years.

The manner in which the central stations sent representatives to attend the electric truck school, which has been held very successfully in New York, Chicago and San Francisco, was most encouraging. The attendance in each school is increasing, and there are several requests for school sessions in other localities.

The truck sales this year will be approximately 50 per cent greater than any other year in electric truck history, and one of the most promising features is that the number of new users of electric trucks will be greater than ever before.

The most important convert of 1923 was the Pacific Gas & Electric Company, which has begun the development of the truck load on a very substantial scale. Interest in other quarters is increasing. I see a very definite evidence of appreciation of the electric truck by central stations.

One of the larger manufacturers of electric trucks has just completed a quarter-million-dollar addition to a factory which was built less than two years ago. It is a very noticeable fact that the electric truck manufacturers are the only truck manufacturers who are working overtime.

Central Stations Are Responsible for Getting Appliances Into Use

BY JAMES E. DAVIDSON
Vice-President and General Manager Nebraska Power Company, Omaha, Neb.

IT HAS been my observation that many light and power companies, particularly in small places, overlook their responsibility as trustees of the electric service in their community in not making considerable effort to educate their customers in the use of labor-saving and convenient appliances and apparatus.

Our national magazines and our daily newspapers carry interesting articles about energy-consuming devices and have a considerable portion of their advertising space filled with attractive advertisements which have been placed there by electrical manufacturers.

This has produced what might be termed a natural demand for electrical merchandise, and it is up to the central-station companies to meet this demand enthusiastically. I say the central stations because we are the natural ones who should dispense these wares. We are better informed regarding their uses. We have a direct interest in seeing that they are satisfactorily operated. We have a selfish interest in wishing them to consume kilowatt-hours and thus increase our gross

business and consequently our net business—because there is little or no increased investment involved.

I do not believe that we can pay too much attention to the building up of gross earnings from the sale of merchandise; however, far too little attention has been paid to selling this merchandise at prices that will protect our competitors, especially the electrical dealers, and to keeping down sales expense so that there will be a real net earning.

I should say here that it is my belief that a merchandising department should carry all expense which is attributed to it. I will admit that our margin of profit is not great; however, the "trick in the bag" is getting the proper number of turnovers.

Central stations doing a merchandising business should not be discouraged even though this department does not have any net earnings early in its career, because, though they may only break even or actually lose money, the business is more than worth while.

They should not discourage department, drug, hardware and other stores, and particularly electrical dealers, from selling energy-consuming devices. In fact, they should offer them encouragement, but should see to it as far as possible that the merchandise which is sold is reliable—that it will render good service and be durable.

A central station must necessarily do considerably more missionary work and render more service than do its competitors. This work is necessary, for our customers must be educated, and in doing it we have an opportunity through our salespeople and repairmen to learn how we can improve the service we are rendering to the public, how to "put over" the public utility message and build up proper public relations.

I have absolute confidence in the progressiveness and energy of the central-station organizations and believe that there should be an increase of 10 per cent or more in merchandising in 1924 over 1923.

Customer Ownership Growing Fast

Probable Large Increase in Sales of Stock to Central-Station Customers During 1923—Cost of Financing by This Plan Very Low

By Fred W. Herbert

Superintendent Service Department, National Electric Light Association

THE continued reassurance of the success of customer ownership of junior securities of public utilities and the practicability of financing electric light and power companies by this method has stimulated many additional companies to adopt this plan as a part of their regular financing program. Certainly this movement has "carried on" well and is advancing with astounding strides, and the public response which has greeted it has exceeded the fondest hopes of its sponsors. Each succeeding year finds new campaigns inaugurated and an increased volume of sales of stock to a largely diversified class of customers and investors. It has also made the selling of public utility securities much easier, owing to the wide publicity given by the companies which have so successfully operated under this plan.

No better indication of this can be found than the statistics on growth shown in the report of the customer-ownership committee of the National Electric Light Association for the year 1922, which shows the number of companies adopting the customer-ownership plan. The starting was made in 1914 with seven companies, and the respective succeeding years added three, four, eight, seven, twelve, thirty and thirty-six up to 1922, when forty-nine additional companies reported that they were selling stock on this plan.

From the preliminary survey for the year 1923 which is now being made for inclusion in the report for this year, the number of additional companies selling stock by this method will be largely in excess of the additional number in 1922.

The name "customer ownership" is universally used, but it now seems that this should be amended to include also "employee ownership." For the success of this plan and the volume of sales due credit should be given to the sales and purchases made by the employees of the utilities selling their stock under this plan. Of fifty-eight companies of the 156 companies reporting to the National Electric Light Association for 1922, 780,438 shares, or 73.9 per cent, were sold to customers; 150,511, or 14.3 per cent, to employees, and 125,491, or 11.8 per cent, to others. The volume of sales was accomplished in most cases through the organization of employees of the companies in teams and clubs composed entirely of the working staff, under the supervision and guidance of the chief executive or security department. In fact, the plan most commonly followed is to place this stock with customers through the company's regular employees. For their assistance and education in salesmanship many of the companies issue an employees' sales manual, and the customer-ownership committee of the National Electric Light Association, thinking that this was an important function of its activities, issued an "Employees' Sales Manual" and a "Standard of Practice." Both of these booklets have had wide distribution, and they have been combined as a textbook for stock salesmen and a guide for companies putting on customer-ownership campaigns.

In the study of customer ownership it has been found that a number of unusual plans are used to stimulate sales by the employees and the company. One of the larger companies operating in a number of communities has a handsome trophy which is awarded periodically to the company employees' organization in the locality where

there is the best record of sales during a certain period, and the presentation of this trophy to the winning organization is made a feature at a banquet given to the employees, at which time instructive sales talks are given by executives and financiers on the subject of salesmanship and the value of customer ownership. It is through employee salesmen that this company has placed the majority of its securities.

It is therefore shown that this plan is as effective for employee ownership as for customer ownership, and it is generally conceded that employee ownership should be encouraged as fully as customer ownership. One large company reports that one out of every three employees is a stockholder, the average individual holding being five shares. The statistics of the 156 companies reporting in 1922 to the National Electric Light Association show that 5.5 per cent of their customers are partners in the business.

There is another outstanding feature in emphasizing the superiority of this plan of financing, which is the low cost or the average cost of selling by these companies. In 1922 this amounted to $4.39 per share on the par value of $100 per share. Another feature which is commendable is the selling of stock on the installment or partial-payment plan, making it easy for customers and employees to become part owners in the company. In the last report the percentage of sales on this partial payment plan was 32.5 per cent.

STABILIZATION OF PLAN

The plan of customer ownership is becoming more and more stabilized, and in the process of stabilization new ideas develop in advertising and publicity. More attractive advertising matter of an educational and instructive nature is being put out, which is not only helpful in selling stock but is educating the general public on public utility financing, the service of the company and the value of the utility to the community which it serves. Many of the companies have adopted a definite policy of keeping their stock continually in the minds of the public and their customers. This is accomplished by a well-planned program of newspaper advertising, display cards, year books and bulletins to employees. Advertising has been extended to include foreign languages, thereby inviting those who are unable to read the language of this country to invest their savings in this way —a plan not only beneficial to the welfare of the communities of which they are a part but one also which keeps in this country the savings of the foreign working element.

Graphic visualization of the number of stockholders by means of charts showing the geographic area which the company serves, with a dot representing each stockholder, has been adopted by many of the companies. The advantages of these charts are indirect, but, judging from the attention prospective purchasers give them, they fully justify their use.

Attention has been called to a unique plan of advertising adopted by one of the companies. It issues to each infant in its territory when the birth is recorded a certificate, good for $2.50, to be applied on the purchase of one or more shares of its 7 per cent preferred stock, and, in order to keep the company in the minds of the parents as well as the children growing up, an additional certificate for the same amount, to be applied in the same way, is issued at each succeeding birthday.

Through this continuous campaign of advertising, "repeating" subscribers as well as new subscribers for stock are obtained at a cumulative arithmetical ratio which operates much like an endless chain. The facts disclose that nearly every buyer of utility securities becomes a "repeater" and can be counted on for a certain amount of stock each year. Another factor is that many of the purchasers are making their first investment, the value of which is more impressive, and as their buying power increases through the years their investment correspondingly will increase. By this plan is shown the incalculable value of making the community which the company serves a community of investors. It is a very important factor in stimulating thrift.

The present indications are that the returns to be compiled for the continued campaigns during 1923 will surpass the record of 1922, in which 198,018 new customer shareholders were obtained through this plan, representing an investment of over $175,000,000. By the end of 1922 a total of 3,449,185 shares of stocks had been sold by these companies through the customer-ownership plan. The 156 companies reporting to the National Electric Light Association in 1922 represented a population served comprising 40 per cent of the entire population of the United States. This proportion will probably be found to have reached 50 per cent in 1923, and it is conservatively estimated that more than $250,000,000 will be found to have been realized from the sale of securities last year. More than 250 companies are now operating under this plan. The returns already received from one company report the sale of 2,358 shares to 932 shareholders in its 1922 campaign. Owing to this success, an additional issue was put out in 1923, of which 5,485 shares were sold to 1,668 shareholders in two and a half days and the issue oversubscribed by 40 per cent. These campaigns have added 1,300 new families to the list of the company's shareholders, and this is only one of the many instances of the increase in the demand for public utility securities by customers and others.

The gross earnings of the companies reporting the use of the customer-ownership plan during 1922 aggregated $555,553,901, or 51 per cent of the total gross revenue of all the central-station companies of the country. Data available indicate that the gross revenue of companies selling their shares and stocks under the customer-ownership plan during 1923 will total more than $700,000,000.

The continuity of dividends and the high financial standing of public utilities due to the absence of speculative features place public utility securities in the very highest class. Their sale to customers promotes friendlier public relations, and it can now be conceded that "public relations" and "customer ownership" have formed a congenial and beneficial alliance. Public utility securities have come to be regarded as the most desirable and attractive class of investment today, and it must be conceded that customer and employee ownership has been a great factor in establishing this record.

Continued demand for the additional capital required for extensions to keep up the demands on the industry and the continued demand from customers and employees for public utility securities assure the further extension of this plan, which embodies the most constructive and sane plan of public ownership.

Future extensions will necessitate millions of new capital, much of which must and can be obtained by the plan of financing through the sale of securities to customers and employees.

The Outlook in the Electrical Business

"Electrical World's" Annual Statistics on Production of Electrical Equipment and Supplies — Prospect for 1924 Exceedingly Promising

THE electrical business enters upon the year 1924 with an extremely interesting and encouraging outlook. The industry as a whole is striding ahead, expanding and growing with a continuous acceleration. The normal curve of the electrical business is upward, and new records have become so familiar a feature of electrical news that they are almost characteristic.

The production of electrical equipment and supplies last year—which is the natural index to growth in the business of the electrical manufacturer, jobber, dealer and contractor—shows a general increase, as is seen in the accompanying table. These figures are, of course, approximate, but they are based on the confidential estimates of the men in best position to judge of the total production of the country. From these estimates an average is taken. In the absence of actual industry statistics, so sorely needed, this is the closest possible approach to totals on electrical manufactures.

High Points of the Year

A number of interesting things stand out in the comparison. The rating on generators sold is about the same as in 1922. The accelerated growth in the number of central-station customers is reflected in the greater number of service watt-hour meters which were sold last year. Fans and washing machines decreased, but vacuum cleaners showed a 34 per cent increase over 1922. The growth in the radio industry is reflected in the large increase in the number of dry batteries sold. Practically all materials entering into building construction show large gains on the previous year. The sale of forty thousand ranges and $2,600,000 worth of electric trucks is notable.

The electrical business enjoyed great prosperity in 1923, and the prospect for the year ahead is most encouraging. In the first place the opening of the new year finds a general business situation conducive to extreme optimism. For example:

1. There is very little unemployment in the United States. A very large proportion of the people are self-supporting and therefore spending money.
2. Savings bank deposits have never been larger. This means that the potential buying power of the people is extremely high.
3. The railroads are steadily becoming stronger financially and operating at a much higher efficiency. They are placing larger orders for equipment and supplies for present and future delivery.
4. The volume of industrial production is very large. Record car loadings indicate a wide distribution of commodities and a heavy consumption.
5. Agricultural conditions are much improved. The farmer is receiving better prices and the mail order houses report greatly increased sales to the farming country.
6. Building construction has been proceeding on an enormous scale and there is every indication that the activity will continue through 1924 and longer.
7. Increased wage scales have opened up a tremendous market for goods that were previously sold only to the "white collar classes." It is not a transferred market but a newly created demand.
8. There is a good prospect for a sweeping tax revision downward that will relieve the average man of a considerable burden and will undoubtedly stimulate the market generally.
9. There is a comparatively easy money market that is making corporate financing less difficult.

So much for general conditions. There are also other trends that are of particular interest and significance.

The public utility industries are enjoying unprecedented prosperity and look forward to rapid growth. The gas industry has taken on approximately 450,000 new connected customers this year, and the market for domestic and industrial gas fuel is increasing even more rapidly than the market for electricity. The telephone industry is going forward more rapidly than equipment can be provided to give service. The street railways of the country are in a far more prosperous condition than for many years. This indicates a growing popular appreciation and support of public utility service, which, of course, is the key to electrical development.

The electric light and power industry has doubled the volume of energy sold within the last four years, as against five years for the cycle preceding. Central-station financing during 1923 broke all precedents, with a total of $100,000,000 for the month of December alone. The great progress in expansion which has been so much in evidence throughout the year will undoubtedly continue through 1924 unabated.

Background Conditions

In addition to all this there are a number of specific conditions which have an important bearing on the electrical business and seem to indicate the most promising prospect. These conditions are:

1. The idea of superpower has taken firm hold among the power companies and interconnection is gaining headway, making available materially increased capacity through exchange of power, for which there is a ready market.
2. A new appreciation of the importance of market development is becoming apparent among central-station executives. A steadily increasing number of companies are going into the merchandising of appliances and on a better basis. An intensive effort has begun to improve the lighting of the home that has already sold as many as ten thousand kitchen lighting units by a single central station, and the idea is sweeping the country. It will produce a very large volume of business.
3. The National Electric Light Association, the Federated Farm Bureau and the United States Department of Agriculture have all combined on a survey of the needs and possibilities of electric power on the farm. It is a big step toward opening up this tremendous market and promises increased business in the rural country almost immediately.

The Manufacturers' Situation

4. Employment by the large electrical manufacturing companies is right now equal to or in excess of the peak of the war period. Sales totals are larger than for corresponding periods last year. Earnings are also greater. And there is every prospect for continued demand and a sustained production on this almost unprecedented scale.
5. Radio sales have already reached the astounding total of $150,000,000 and are expected to be double that figure next year. The sales of vacuum tubes now reach 20 per cent of the value of the total sales of incandescent lamps. Manufacturers, jobbers and contractor-dealers will all share

directly in this enormous business. But in addition the entire industry is benefiting to an incalculable degree by the education in electricity that radio bestows upon its devotees. It is making both children and grown-up persons more familiar with electricity, and this inevitably will influence greater use of electric service.

6. The electrical industry is better organized than it has ever been before. Much progress has been made in the last year in the development of a practical harmony between the different groups of electrical men that cannot fail to stimulate the electrical business and add to its prosperity.

Such is the situation that confronts the business men of the electrical industry today. It is highly improbable that any general or industry business depression will develop so long as such conditions prevail. All indications point to a firm or a moderately rising price level, the maintenance of at least a normal manufacturing output, and the continuance of good business throughout the first half of the year 1924 and probably for a much longer time.

Statistical Data on the Production of Electrical Equipment and Supplies During 1921, 1922 and 1923

Item	1921 Number of Units	1921 Manufacturer's Value	1922 (Revised) Number of Units	1922 (Revised) Manufacturer's Value	1923 Number of Units	1923 Manufacturer's Value
Generators						
Waterwheel	196,000 kw.	$1,100,000	1,200,000 kw.	.....	1,500,000 kva.	
Turbo	510,000 kw.	.....	1,575,000 kw.	.....	2,020,000 kva.	$32,300,000
Insulated Copper Wire						
Rubber covered	.....	40,000,000	.....	$60,000,000	.....	78,000,000
Total code	1,271,000,000 ft.	17,408,000	1,700,000,000 ft.	25,600,000	2,114,500,000 ft.	26,300,000
No. 14 code	890,000,000 ft.	5,785,000	1,200,000,000 ft.	13,000,000	1,268,700,000 ft.	13,700,000
Flexible cords	95,000,000 ft.	.....	266,000,000 ft.	3,000,000	226,000,000 ft.	3,400,000
Transformers						
Distribution type	.....	6,000,000	.....	12,000,000	.....	17,000,000
Power type	.....	6,000,000	.....	11,000,000	.....	14,000,000
Transmission Equipment						
Poles, steel	.....	.....	.....	.....	.....	900,000
Poles, wooden	.....	.....	.....	.....	800,000	20,000,000
Pole-line hardware	.....	.....	.....	.....	.....	12,000,000
Cross-arms, wooden	.....	.....	.....	.....	.....	3,500,000
Low-voltage insulators	.....	.....	.....	.....	.....	3,000,000
High-voltage insulators	.....	.....	.....	.....	.....	3,500,000
Meters						
Switchboard instruments	.....	.....	.....	.....	.....	3,000,000
Service watt-hour	1,500,000	.....	1,750,000	.....	1,950,000	18,100,000
Industrial control	.....	15,000,000	.....	25,000,000	.....	29,000,000
Motors						
Fractional	.....	15,000,000	.....	30,000,000	.....	30,000,000
1 hp. to 50 hp.	.....	30,000,000	.....	50,000,000	.....	66,000,000
51 hp. to 200 hp.	.....	5,000,000	.....	7,500,000	.....	9,900,000
Above 200 hp.	.....	1,000,000	.....	1,600,000	.....	2,500,000
Lamps						
Type "B"	134,000,000	.....	165,000,000	.....	192,000,000	.....
Type "C"	27,000,000	.....	40,000,000	.....	48,000,000	.....
Carbon	7,000,000	.....	5,000,000	.....	1,000,000	.....
Miniature	105,000,000	.....	95,000,000	.....	100,000,000	.....
Appliances						
Ranges	.....	.....	.....	.....	43,000	4,200,000
Refrigerating machines	.....	.....	.....	.....	13,000	2,300,000
Domestic heating appliances	.....	14,040,000	.....	17,000,000	.....	20,000,000
Industrial heating appliances	.....	900,000	.....	1,100,000	.....	1,500,000
Fans	700,000	10,000,000	900,000	10,500,000	705,000	8,750,000
Washing machines	415,000	42,616,000	600,000	42,000,000	560,000	39,200,000
Vacuum cleaners	600,000	30,000,000	700,000	35,000,000	935,000	32,400,000
Fixtures						
Residential lighting	.....	.....	.....	.....	.....	46,000,000
Commercial lighting	.....	.....	.....	.....	.....	8,100,000
Industrial lighting	.....	.....	.....	.....	.....	8,600,000
Street lighting	.....	.....	.....	.....	.....	4,000,000
Shades	.....	.....	.....	.....	.....	17,000,000
Wiring Supplies						
Rigid conduit	58,000 tons	7,000,000	120,000 tons	15,000,000	132,000 tons	16,500,000
Non-metallic flexible conduit	98,000,000 ft.	2,500,000	175,000,000 ft.	2,500,000	193,000,000 ft.	2,750,000
Metallic flexible conduit	.....	100,000	.....	150,000	.....	165,000
Flexible armored conductor	.....	4,000,000	.....	5,000,000	.....	5,500,000
Outlet boxes and fittings	.....	1,200,000	.....	1,300,000	.....	1,500,000
Friction tape	10,800,000 lb.	.....	15,000,000 lb.	.....	16,500,000 lb.	.....
Rubber tape	1,200,000 lb.	.....	3,000,000 lb.	.....	3,300,000 lb.	.....
Fuses, renewable and non-renewable	.....	4,500,000	.....	7,000,000	.....	6,000,000
Wiring Devices						
Key sockets	7,500,000	.....	14,500,000	.....	17,700,000	.....
Pull sockets	5,000,000	.....	9,500,000	.....	11,600,000	.....
Keyless sockets	2,750,000	.....	5,300,000	.....	6,500,000	.....
Flush switches	6,000,000	.....	7,500,000	.....	9,200,000	2,800,000
Exposed switches	4,000,000	.....	4,500,000	.....	3,250,000	700,000
Safety switches	.....	.....	.....	.....	860,000	2,900,000
Plugs	8,000,000	.....	12,000,000	.....	15,000,000	1,400,000
Receptacles	8,000,000	.....	10,000,000	.....	10,000,000	1,500,000
Batteries						
Storage	.....	.....	.....	.....	.....	5,000,000
Starting and lighting	3,200,000	40,000,000	.....	65,000,000	.....	*105,000,000
Dry	50,000,000	.....	100,000,000	.....	115,000,000	.....
Electric Vehicles						
Trucks	1,000	.....	1,250	.....	.....	2,600,000

*Including radio.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Photostat copies or English translations of complete articles will be furnished at cost upon request

Hydro-Electric Development and Steam Equipment

Refractories for Stoker-Fired Boiler Settings.—In co-operation with an advisory committee composed of producers and consumers of refractories, the Bureau of Standards has undertaken the establishment of specifications to be used by the government departments in the purchase of these materials. An important part of this work, which is now nearly completed, deals with refractory brick for the lining of stoker-fired boiler settings. The brick tested represented forty-two brands supplied by users in all of the important industrial districts of the country. Specimens have been subjected to the standard and modified load tests and the endurance, constant volume and quenching tests. Absorption tests before and after various heat treatments were carried out, and the fusion points and chemical composition were also determined. The results of the load tests checked closely those obtained in previous investigations and show clearly the relative behavior of brick from various districts in the United States. Results of the investigation also indicate a close relation between chemical composition, fusion point and resistance to sudden temperature change, and these also agree quite satisfactorily with the results of the endurance and constant-volume tests previously conducted.—*Technical News Bulletin No. 79 of the Bureau of Standards.*

Power-Plant Problems as Viewed by Designers, Operators and Manufacturers.—A symposium of seventeen short articles discussing the problems at present confronting the power-plant field. Fuel saving, plant design, higher steam pressures, power generation and pulverized fuel are among the subjects discussed.—*Power,* Dec. 4, 1923.

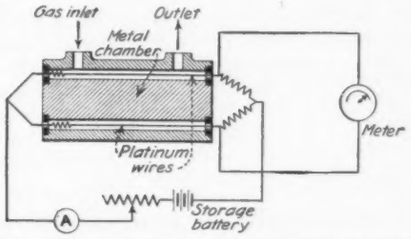
Combustion Problems Analyzed.—T. A. MARSH.—The selection of fuel, the selection of stoking equipment, the design of the furnace and the operation of the plant are the most important problems that must be solved before an efficient plant can be built. The author analyzes these problems in detail.—*Canadian Engineer,* Dec. 11, 1923.

Large Turbines at Swedish Hydro-Electric Stations.—F. JOHNSTONE-TAYLOR. — Turbine installation in Sweden and Norway bear evidence of sound engineering and a keen desire on the part of their promoters to make them the best of their kind. Most of the developments make use of the double-wheel horizontal Francis turbines and vertical-shaft turbines of the type used to a great extent in America. This article is principally concerned with some of the large double-wheel horizontal units recently installed at one large power station.—*Electrical Times (England),* Dec. 6, 1923.

Units, Measurements and Instruments

A Monochromator for Research Work.—A monochromator has been designed for rapid adaptation to various requirements which may be met with in a research laboratory in observing the ultra-violet, visible and near-infrared spectrum. The instrument can be arranged to deal with almost any optical problem.—*Journal of Scientific Instruments (England),* November, 1923.

Testing Flue Gases.—FOLKE K. G. ODQVIST.—The article describes a new flue-gas tester made by a German concern. The fundamental principle of the apparatus is based on the difference in the transmission of heat by different gases. The arrangement is shown in



DIFFERENCE IN HEAT TRANSMISSION OF TWO GASES OPERATES THIS FLUE-GAS INDICATOR

the accompanying illustration. A metal chamber has two passages in which are placed two platinum wires. One wire is surrounded by atmospheric air while the other wire is surrounded by the gas to be tested. The platinum wires are heated electrically from a storage battery. The relative cooling effect is established by determining the resistance in a Wheatstone bridge circuit. The readings of the meter can be calibrated in units of per cent CO_2 or for any other gas. Comparative readings with Orsat and Mono apparatus have shown that the arrangement is reliable. — *Teknisk Tidskrift (Sweden), Allmänna Avdelningen,* Nov. 17, 1923.

Generation, Control, Switching and Protection

Theory and Performance of Electrolytic Rectifiers.—On account of the growing use of rectifiers for charging portable storage batteries, and the general lack of information on their performance, the bureau undertook a study of their comparative efficiencies under different conditions of service. In order to explain the effect of the characteristics of the circuit upon the wave form of the rectified current as observed by the oscillograph, it was necessary to make a thorough study of the mathematical theory of rectification. The principal factors studied were the effect of inductance with and without iron cores, the capacity of the rectifying electrode and the counter electromotive force of the battery being charged as they affect the energy efficiency, power factor and the ratio of average current to the root-mean-square value as well as the wave form of the rectified current. The material is being prepared for publication.—*Technical News Bulletin No. 80 of the Bureau of Standards.*

High-Voltage Switches, Bushings, Lightning Arresters. — HAROLD MICHENER.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. Pacific Coast convention, Oct. 20, 1923, page 803.—*Journal of A. I. E. E.,* December, 1923.

Transmission, Substations and Distribution

Transformers for High-Voltage Systems.—A. W. COPLEY.—The designs of transformers for 220-kw. systems do not represent radical departures from designs which have become standard for lower voltages. The solidly grounded neutral system is used, and advantage is taken of this to use graded insulation and reduced voltage test. Auto-transformers are used to connect between the 220-kw. system and existing high voltages and are connected star-star with delta tertiary. The tertiary may or may not be used to supply synchronous condensers, but it is not used for the supply of power load.—*Journal of A. I. E. E.,* December, 1923.

Condenser-Type Bushing Insulators. —G. L. E. METZ.—The author makes some observations on the designed features of condenser bushing insulators and then gives a formula for determining the potential gradient at any point in a bushing, which is $g = v/x \log_e (R/r)$, where g is the potential gradient, R the external radius of insulator, r the radius of the inner conductor, x the distance from the conductor, and v the maximum instantaneous value of test voltage. The metallic cylinders comprising part of the bushings are especially designed and straight one to another, so that the capacity of each section is constant throughout the bushing. Considerations affecting the radial dimensions are also dealt with.—*Electrical Review (England),* Nov. 30, 1923.

Electrolytic Rectifiers.—M. A. CODD. —Following a number of experiments on the rectifying properties of aluminum cells, attempts were made to produce a commercial device which would run a long period without attention. Experiments along this line and the results therefrom are given. As a result of the tests it was concluded that for satisfactory operation two conditions are desirable, first, some method of presenting the anode from polarizing and, second, the arrangement of a leak between the two electrodes of the cell.—*Electrical Review (England),* Nov. 9, 1923.

Illumination

Lighting Data.—Four bulletins have recently been published by the Edison Lamp Works of the General Lamp Company on various phases of illumination. Bulletin L.D. 147, by L. C. Porter and G. F. Prideaux, discusses lighting for traffic control on land, on the water and in the air. Signals for street traffic, signals and warning beacons for railroad traffic, marine signaling and aërial navigation, including the lighting equipment of the ship and ground equipment, are considered. Bulletin L.D. 148, by G. H. Stickney, discusses need of regulations, state and other codes now in operation, industrial and school lighting codes and regultions for motor-vehicle headlight and tail light. Bulletin L.D. 149, by J. A. Summers, gives a short summary of the development of illumination in the art of photography and considers the use of electric lamps in studio lighting, commercial and home photography, printing, copying, enlarging, dark-room and night photographs. Bulletin L.D. 150, by W. H. Rademacher, takes up the lighting of steel mills and foundries. In it are discussed the requirements of the various sections and operations in detail, with recommendations as to the best practice. Numerous photographs, illustrating the application of the modern principles now followed in this industry, accompany the text.—*Bulletins of the Edison Lamp Works.*

Motors and Control

Rolling-Mill Equipment.—W. E. TAYLOR and C. E. RAEBURN.—Present-day problems in design and construction are discussed. The author makes the important point that the drive chosen should not be either underpowered or overpowered. The former means a curtailment of construction, and the latter necessitates unprofitable capital expenditures and maintenance costs and on the electrical side gives rise to difficulties with poor power factor. It is shown that by the greater use of electrified mills better iron and steel will result.—*Electrician (England)*, Nov. 30, 1923.

Technical Problems in the Rubber Industry.—A. H. SMITH.—The work of the technical man naturally divides itself into factory control, factory development and laboratory research. Factory-control work is divided into checking the qualities of the raw materials, such as rubbers, fabrics and compounding ingredients, and checking the various factory operations. Factory-development work concerns itself with improving the machines and operations which may save time, labor or material and also includes changes in working formulas that may be necessitated. Laboratory research includes research which is directly applicable to factory problems, such as the investigation of new materials, as well as pure theoretical research, which has no immediate direct bearing. All of these factors are discussed in detail. The author points out that at present very few factories are spending much time on purely theoretical research. The most important problems yet to be solved are the cause for the action of accelerators, cause for the action of fine compounding ingredients, the perishing or aging of rubber goods and the development of methods and machines for making accurate physical tests on both vulcanized and unvulcanized rubbers.—*Armour Engineer (Armour Institute of Technology)*, November, 1923.

Heat Applications and Material Handling

Use of Welding in Power-Plant Piping.—L. J. SFORZINI.—Welded pipe lines are now in use and under construction in power plants all over the country. The author, who has made extensive use of welded piping installations for a variety of purposes, gives his experiences on this method of joining pipes.—*Power*, Nov. 20, 1923.

Self-Baking Electrodes.—FRANK HODSON.—The Soderberg self-baking electrode is widely used in Europe in electrothermic industries, where it has demonstrated its value in tilting electric steel furnaces. This articles discusses its use in carbide and ferro-alloy furnaces and points out the advantages of its application to electric steel.—*Iron Age*, Dec. 13, 1923.

Current Buses for Furnaces and Synchronous Converters.—J. L. MCK. YARDLEY.—A practical discussion of the difficulties encountered due to magnetic effects in carrying heavy alternating current short distances in industrial plants.—*Blast Furnace and Steel Plant*, November and December, 1923.

Electrophysics, Electrochemistry and Batteries

Storage-Battery Locomotives for Mines.—J. T. PRINGLE.—The author discusses the present position of the storage-battery locomotive in England, together with the problems which must be solved before development along the right line can be expected. At present it is claimed that there is no battery which will work continuously and efficiently for eight hours without recharging, that the problem of gradients with all drives has not been overcome and that the controllers available are not strictly explosion-proof. Both the limitations of the battery and the effect of gradients make it necessary that arrangements should be available for the easy recharging of the batteries. —*Electrician (England)*, Dec. 7, 1923.

Mackay Electrochemical Process for Copper Ores.—H. S. MACKAY.—The author discusses how sulphide or oxidized material is first roasted in furnaces adapted for close temperature and gas control, the process of making iron and other impurities largely insoluble and then the manner in which copper is leached and electrolytically deposited. The entire process is described in detail.—*Engineering and Mining Journal-Press*, Dec. 8, 1923.

Traction

Emergency Braking on Electric Cars.—A series of braking tests on several types of city and interurban cars were made during May by a special committee of the Central Electric Railway Association. These tests were made to determine the most efficient way to stop a car and the distance required to make the stop. Necessary apparatus was installed in each car to get a complete record for the variable element of each stop under different conditions. Straight air-brake, automatic air-brake and dyamic brakes were employed. It was found that for speeds below 10 miles per hour the car could be stopped in a shorter distance with dynamic braking than by the use of air, while at higher speed the air brake stopped the car in a shorter distance. The report consists of 150 pages and gives a detailed account of all of the tests conducted.—*Bulletin No. 13, Engineering Experiment Station, Purdue University.*

Electric Locomotives for Mexican Railway.—G. H. WALKER.—Ten 150-ton 3,000-volt direct-current electric locomotives for both freight and passenger service are being built for the Mexican Railway Company. These locomotives are of the 04440 type and have a tractive effort of 46,200 lb. continuous, with a horsepower of 2,500. Mechanical and electrical control features of the locomotives are discussed.—*Railway Age*, December, 1923.

Telegraphy, Telephony, Radio and Signals

Experiences with a 202-Mile Carrier-Current Telephone.—E. A. CRELLIN.—The Pacific Gas & Electric Company is operating a carrier-current telephone system between Pit River power house No. 1 and its Vaca-Dixon substation. The general characteristics of the installation with a short description of the apparatus are given.—*Journal of A. I. E. E.*, December, 1923.

Spectro-Radiometric Analysis of Radio Signals.—CHESTER SNOW.—In order to obtain a basis for measuring the interference-producing quality of a radio station, measurements were undertaken at the Bureau of Standards by R. T. Cox to develop a method of spectral analysis of a radiation by means of a receiving circuit whose resonance frequency could be varied through wide limits by varying the capacity in series. Since the resonance peak of a circuit cannot be made infinitely narrow, the latter will respond not to one wave length only but to a considerable range of wave lengths. The interpretation of the observed current as a function of the characteristic frequency of the circuit requires that it be found how the circuit affects the record in order that the spectral distribution of energy may be derived therefrom. Four different forms of solution for obtaining this result are given.—*Scientific Paper No. 477 of the Bureau of Standards.*

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Coal Strike Unlikely

Thought at Washington that Bituminous Agreement Will Be Renewed—Legislation Improbable

WASHINGTON advices are to the effect that leaders of the United Mine Workers and among the coal operators alike are convinced that of all times next spring would be the worst possible time to have a bituminous-coal strike and that therefore the operators and the mine workers who will participate in the wage conferences will, after a period of bluffing to appease the extremists in both the contending camps, agree to extend the present agreement for another year. The usual three months of uncertainty and dissension—in some ways nearly as bad as a strike—will, however, probably precede the new agreement.

There is another reason for believing that neither side is going to precipitate a strike this year. Congress is in session. It is going to take all of the legislative influence of the operators and all of that of the union to prevent legislation which neither wants. Let there be a strike and the demand for this legislation will be such as to insure its prompt enactment.

If a strike is avoided, the chances seem to favor the passing of the session without coal legislation. The administration has shown no disposition to urge even the legislation recommended by the Coal Commission. Secretary Hoover is outspoken in his belief that the main remedy needed by the coal industry lies outside the legislative field. The operators oppose new legislation. Labor opposes it.

Metric Standards Bill Introduced in Congress

A metric standards bill has been introduced in the House of Representatives by Representative Britten of Illinois and in the Senate by Senator Ladd of North Dakota. The legislatures of these states, in company with others, have petitioned Congress to enact metric standards laws.

According to the provisions of the Britten-Ladd bill, the buying and selling of goods, wares and merchandise will be in terms of the metric units after a period of ten years. Manufacturers are to use whatever measures they choose in production, the bill providing "that nothing in this act shall be understood or construed as applying to the construction or use in the arts, manufacture or industry of any specification or drawing, tool, machine or other appliance or implement designed, constructed or graduated in any desired system." Many great industrial concerns are, it is said, urging the metric legislation on this basis.

Southern California Edison's Development Program

The development program of the Southern California Edison Company for 1924, recently announced, contemplates the expenditure of $26,288,000 for new work. Following are the major items included in the budget:

Florence Lake tunnel	$5,879,000
New 25,000-kva. unit in Big Creek power house No. 1 and new 16,000-kva. unit in power house No. 2, both to be placed in operation in 1925	2,100,000
Dam and tunnel work	1,700,000
Steam plant, rated at 70,000 kw., and additions	3,000,000
Distribution lines	5,943,000
Distribution substations	2,394,000
Transmission lines and stations	1,106,510

The new steam plant will be at Long Beach and will probably be installed in a building adjacent to the present plant. Two 35,000-kw. horizontal steam turbines and eight 1,600-hp. boilers will be installed. Six new 60,000-volt transmission lines will be constructed.

Work on Diamond Creek Plant Begun on State Permit

Despite the fact that the Federal Power Commission has not granted a license to J. B. Girand of Phoenix, Ariz., to go ahead with his power project on Diamond Creek, word comes from Arizona that, acting under the state license, which would otherwise have expired on Dec. 26 and which Governor Hunt had said he would not extend, Mr. Girand has begun work at the site of the dam. This action doubtless has been taken to preserve his rights under the state license and in the hope of bringing the issue, with which the seven-state compact is involved, to a head. The Federal Power Commission having taken jurisdiction, obviously the project cannot be carried far without its sanction, and it is expected that an injunction will be sought by it.

Eighteen men are said to be at work on the site, where activity began on Dec. 18. Mr. Girand's original application in Arizona was for permission to construct a dam 300 ft. high and 1,200 ft. long, and the development was put at 200,000 hp. He assigned his permit from the Federal Power Commission to the Colorado River Engineering & Development Company.

Boston Rate Readjustment

Municipal Discount Abolished—Step Rate Introduced—Changes Made in Several Schedules

EFFECTIVE Feb. 1, 1924, an extended readjustment of the rate schedules of the Edison Electric Illuminating Company of Boston will take place, according to advices filed with the Massachusetts Department of Public Utilities by President C. L. Edgar. Although the new schedule is a readjustment affecting only about 5 per cent of the company's 195,000 customers, it contains several features of general interest. It does away with the former municipal discount of 25 per cent; it introduces a step rate into the general rate covering the great majority of customers; it changes billing from the former basis of the average demand for the three winter months in certain classes of customers' installations to the basis of monthly demand peak, and it adds what might be termed a general residential power-rate clause to the existing clause providing a rate for battery charging, electrolytic and plating work, water supply, irrigation, cooking, direct heating and refrigeration by compression.

The general service rate of 9.5 cents per kilowatt-hour will apply to consumptions up to 1,000 kw.-hr. per month, but from 1,000 kw.-hr. to 5,000 kw.-hr. the rate will be 8 cents and above 5,000 kw.-hr. 3.5 cents per kilowatt-hour. In residences motors up to 1 hp. rating may be operated on the so-called miscellaneous energy rate, thus enabling customers having small power-driven apparatus to take advantage of the rate favorable for that class of service.

The general house-lighting rate is not affected, and the 170,000 customers of this class will continue to pay 9.5 cents, the lowest rate in the company's history for this service. The coal clause and "10 per cent addition" clause, originally expected to be made temporary when they became necessary because of war conditions, are now included in some of the readjusted rates because those conditions still exist. Customers who are receiving exceptionally low rates, as large users of electricity, are subject to a very slight increase. The rate for electric cooking is increased by the addition of about 2 mills per meal per person and is still one of the lowest in the United States. No increase of revenue to the company as a whole is expected, but a more accurate sharing of the costs of different classes of service is sought.

H. L. Doherty Denies Claim

His Firm, He Says, Owes Sperling & Company Nothing Either Legally or Morally

REGARDING the suit of Sperling & Company, London bankers, against Henry L. Doherty & Company, Mr. Doherty upon his return to New York City made this statement to the ELECTRICAL WORLD:

"We have never at any time had any general agreement of division of profits with Sperling & Company on the basis of one-half to each, as alleged in their complaint. We did from time to time, under specific agreements in each case, sell certain securities to Sperling & Company, out of which purchases in each case they made substantial profit.

"In connection with the agreements for the sale of securities of the Consolidated Cities Light, Power & Traction Company they were given interests in options which we received for the purchase of additional stock in that company. The option, however, was to buy the stock at par, and the stock of that company never reached par; the option was never exercised either by them or by Henry L. Doherty & Company, and the reason the option did not become valuable was because of Sperling & Company's failure to take securities which they contracted to take, based on which agreements Henry L. Doherty & Company had taken obligations. Now that Henry L. Doherty & Company have worked out these obligations, Sperling & Company attempt to make a claim for an accounting.

"Some of the papers have erroneously reported that the complaint claims some twelve million dollars. This is incorrect, and the figures refer to the amounts of securities which they claim to have sold. The only definite statement in their prayer is for an accounting of the transactions between Sperling & Company and Henry L. Doherty & Company, and the only statement they make is that their claim is in excess of three thousand dollars. It will readily be seen that the Cities Service Company is in no way involved.

"I do not know why they make any claim at this late date—some twelve years after they claim the agreement was made and more than ten years after they claim to have purchased the last securities. If the claim could have been considered of any value, one would naturally have expected them to present it long before this. In the light of the various actions which have been brought against Sperling & Company in England for their failure to purchase stocks of various shipbuilding companies, which contracts they repudiated, but upon which the courts have held them liable, it would seem that this suit must have been brought for the purpose of bolstering up their credit. Sperling & Company repeatedly failed to live up to their agreement to purchase securities.

"It will readily be seen that we believe, contrary to their claim, that we owe them nothing, but that, on the contrary, they owe us large damages which in the light of their action we feel called upon to claim. While I regret the publicity (given in my absence in St. Louis at the American Petroleum Institute meeting), I have no fear whatever of the result. I am sure we are morally—and, our attorneys advise, also legally—entirely correct in this matter."

Floods Again Hamper Supply of Electricity in Paris

Press dispatches report Paris as again undergoing flood conditions, brought about by the rising of the Seine, which, though as yet less serious, are comparable with those in former years—notably 1910. Two of the largest railroad stations—the Gare d'Orléans and the Gare des Invalids—have had to be closed. Many suburban street-car lines have been compelled to suspend traffic, some of them on account of the tracks being submerged and others because the electric power stations have been invaded by water. One of the worst features of the situation is the lack of electrical energy, necessitating the shutting down of some important factories and the laying off of workers.

Governor Smith Propounds a New Policy

Advocates Establishment of New York State Power Authority to Finance and Control Hydro-Electric Development—Still for Municipal Regulation

A SALIENT feature of the message delivered by Gov. Alfred E. Smith to the New York State Legislature on Wednesday of this week is a proposal concerning water power which differs in its terms from any heretofore made by the Governor or other state officials. Governor Smith proposes that there be set up a holding corporation to be known as the New York State Power Authority, with administrative machinery similar to that of the existing New York State Port Authority and with power to raise a working capital fund by the issue of bonds without the necessity of a referendum to the voters.

Again declaring that the state should perpetually own and develop its water-power resources, and after referring to the "tremendous possibilities for commercial development, labor saving and human happiness generally in power development on a large scale under proper regulation and control," Governor Smith said:

"The development of power is not simply a matter of engineering and construction. We have heard much recently of superpower proposals—that is to say, power development which would break down state lines and state control and develop power on a regional basis. If such projects are turned over to private companies, a monopoly may be created more powerful and more sinister than any which this country has known before. It might control all industries, municipalities and even homes and farms. It might determine who shall have power and who shall not—thus denying it to the farm and industry in outlying districts, except at a very high price, and it could at will throttle or expand the growth of communities on the basis of profit, and not on the basis of the common good.

REJECTION OF ADIRONDACKS AMENDMENT

"In unmistakable terms the people of this state have just rejected an amendment to the constitution which would have permitted the development of water power in the Adirondacks by private corporations and allowed the building of transmission lines through the Adirondack Park, and would have legalized the unconstitutional development of water power under the guise of river regulation. This referendum vote was widely discussed and brought about an understanding of the water-power problem such as we have never had in this state before. The results must be regarded as indicating clearly the future attitude of the people of this state toward the development of water power. Once the great rights, franchises and properties of the state in water power and the rights-of-way are granted to a monopoly, they can only be repurchased and condemned at prohibitive prices. This has been the history of gifts of public resources and rights-of-way for the past century.

"It seems to me to be possible to develop immediately a policy for the State of New York which will assure the fullest development and use of hydro-electric power in the interests of all the people. New York owns some of the most important water-power resources in the whole eastern region. It is not wholly or even primarily dependent upon coal for the development of power. Under the agreement recently reached with the Federal Power Commission, it is clear that the State of New York owns not only the power from its inland streams, but also the primary sources of power on the New York side of the great international streams of the Niagara and St. Lawrence Rivers. Up to this time I have had to content myself with a general announcement of policy in favor of public ownership, and with a program which I am prepared to admit was primarily conceived to prevent the proponents of private ownership and development from giving away resources of the state and shaking off all state control and supervision; but we know now that the public will no longer tolerate the existence on our statute books of the power bills passed by the Legislatures of 1921 and 1922, and to my mind the time has come to adopt a policy in line with public sentiment and with the future welfare of the state.

"In my opinion the chief obstacle to the policy of state development advocated in the past is that it contemplated the use of state money or state credit and the issuance of state bonds. Such action would require a popular referendum and, moreover, would involve the use of public money, which past legislatures have been unwilling to appropriate. I think we all agree that state ownership requires control by the state of power at the source.

ESTABLISHMENT OF POWER AUTHORITY

"I therefore advocate that we establish a New York State Power Authority which shall be a public corporation, municipal in character, having no stockholders, deriving its powers from the state and having duties specifically imposed upon it, to take over and develop the power resources of the state. Such a public corporation should be given the power to issue bonds, which should be exempt from state taxation, secured entirely by the revenues to be derived from the improvements when made. It should not be given power to tax or assess property owners, nor should its bonds or certificates be regarded as debts or obligations of the state. There is scarcely any doubt that the great revenues to be derived from the construction of these valuable enterprises will attract investors, on the basis of a reasonable interest return and without the larger returns that are expected by stockholders investing in private corporations. The valuable franchises which the state itself would own would be capitalized, not in the interest of private stockholders, but in the interest of the public. The service which they would render in furnishing cheaper light, heat and power would be subject always to the control and regulation of the state itself. This agency can be charged, first of all, with the study and preparation of plans for the development and use of our water-power resources. It will be the permanent planning agency of the state as well as the representative of the people in guarding, developing and utilizing these resources.

"Great projects are now under way all over the country for power development, reclamation, irrigation, port development, tunnels and similar undertakings through public or municipal corporations, created by sovereign states investing such corporations with the power to own, construct and in many cases operate great public improvements and the power to issue their own bonds exempt from state taxation. There is, therefore, nothing new or untried in my proposal.

"I would suggest that such an authority be composed of three representative citizens of the state appointed by the Governor for overlapping terms of reasonable length. Such an authority should be empowered to co-operate with the Canadian authorities and perhaps eventually to form a general commission with a similar group from Canada for the development of the Niagara and St. Lawrence powers. The New York authority should, however, function as to all power projects and undertakings in this state. It should represent the state in conferring with federal authorities on navigable streams and with both the federal and Canadian authorities where international streams are concerned. This authority should represent the state in conferences with other state and federal authorities on giant or superpower plans and should be in a position to build the giant power lines if necessary. We are not in this state opposed to any superpower plan. We are ready to deal with anybody for the use of our power in return for power from other states. But before we talk superpower plans we should develop and control our own sources of supply in our own state.

"I am firmly convinced that if we do not set up an authority of this kind no progress can be made. The political, social and economic factors in this problem will not permit unregulated private development. The people of the state will not give up their rights to any regional superpower monopoly on the basis of the slogan that there shall be free flow of power across state boundaries.

"I therefore call upon you to repeal the laws passed in 1921 and 1922, to obey the mandate of the people as expressed on the referendum last fall, and to pass the bill which will be introduced shortly providing for the setting up of the New York Power Authority as the trustee of state power resources and the planning and control agency of the people of the state. This is a definite proposal, practical and capable of immediate usefulness. It contemplates no added financial burden on the state and enables the state to develop its own resources immediately and to participate in any interstate or international projects, protecting our own rights and conserving them for the benefit of all the people."

FOR MUNICIPAL REGULATION

The Governor again favors the regulation of utilities by municipalities rather than by the state, especially where the utility is contained within the city boundaries. His recommendation of last year that regulation should be carried on by the cities except where they elect to "contract out" and accept control by the state commission is, however, changed to a recommendation that municipalities shall have the right to petition the Legislature for the power to act as the state's agents in regulation. He advocates the abolition of the present commission and the vesting in the Governor of power to appoint not more than three commissioners to regulate in any case such utilities as are state-wide or not confined to a city. He reiterates his opinion that the Transit Commission should be abolished and that New York City should have complete control of its own railroads and bus lines.

Governor Smith also declares for the right of the voters to initiate amendments to the constitution.

Hetch Hetchy May Begin to Deliver Power Next Year

THE last 3-mile section of the 18-mile tunnel which forms part of the Hetch Hetchy water-supply and power project of San Francisco was bored through on Nov. 26, and no great engineering tasks remain to be solved. The above sketch shows the general plan of the great undertaking and the sites of the proposed power houses on Moccasin Creek. The first unit, which the city engineer hopes will be ready to deliver power before 1925, will develop a total reaching approximately 52,000 hp.

Electric Ultra-Microphone

Phillips Thomas of Westinghouse Company Perfects Device to Magnify Audibility Greatly

THE perfection of an electric ultra-audible microphone, invented by Dr. Phillips Thomas, a research engineer with the Westinghouse Electric & Manufacturing Company, to record sound vibrations which are too rapid or too faint for the human ear to catch, has been announced by that company.

In its experimental stage, according to S. M. Kintner, the company's director of research, the microphone has been used successfully to transmit by radio the highest notes of the voice and of musical instruments which the ordinary transmitter and receiver reproduce as mere noises. He declares the device has been so perfected that ships can pick up the warnings of foghorns or other sound warnings beyond the range of the human ear; that the finer sound vibrations of organs of the human body, such as the heart and brain, can be studied, and that entomologists can distinguish the sounds made by tiny insects heretofore inaudible to human beings.

"To all these sounds the normal human ear is in the same relation as the deaf person is to sounds we hear distinctly," said Mr. Kintner. "The ultra-audible microphone will do for the human ear what the microscope does for the eye. With the new device, which will register sounds of an infinite number of vibrations from 20,000 up, we shall be able to reproduce and record, if not to hear, all the sounds of the earth of which heretofore we have remained in complete ignorance."

Dr. Thomas' device consists of a ring of insulating material on the inner side of which two tiny electrodes are set opposite each other. A high voltage is passed through the electrodes, producing a soft, purplish-glow discharge as it flows through the air between them. This flowing light is highly sensitive to sound vibrations, flickering with the sounds and causing changes in the flow of current which can be transmitted to reproducing machines or recorded by a stylus.

Members of the department of entomology at the American Museum of Natural History in New York declared that the new microphone, if made available to science, would open a vast realm of study to the entomologist.

Los Angeles Still Eager for Valuation of Utility

An ordinance has been passed by the City Council of Los Angeles authorizing the local Board of Public Service Commissioners to spend $45,000 for the expenses of a valuation of the electrical properties of the Los Angeles Gas & Electric Corporation to be made by the California Railroad Commission at the instance of the city. At the same time the ordinance authorizing the expenditure of $25,000 for the same purpose which was passed by the Council in October was repealed.

The company had filed a referendum petition against the original ordinance which required either its repeal or its submission to the voters at the next regular election. In the meantime the Railroad Commission told the city that at least $50,000 would be required to make a valuation of the property. The referendum petition was thereupon nullified by the repeal of the measure and the passage of two new ordinances, one for $45,000 and the other to cover $5,000 which has already been expended. The company will immediately circulate another petition requiring the new proposition to be voted on in May.

Los Angeles has been trying for more than a year to have a valuation of the private company's property made with a view to condemning it and making it a part of the municipal light and power system. The private company has been competing with the municipal system since the properties of the Southern California Edison Company within the city limits of Los Angeles were taken over by the city.

Mayor of Detroit Vetoes the Babcock & Wilcox Contract

Award of the contract for furnishing and installing eight boilers and eight superheaters at the new municipal power plant of Detroit to the Babcock & Wilcox Company has been vetoed by Frank E. Doremus of that city because that firm was not the lowest responsible bidder, as the city charter requires. As recorded in the ELECTRICAL WORLD for Aug. 25, 1923, when a tabulated schedule of bids was printed, this award was made by the City Council of Detroit on the recommendation of the Public Lighting Commission after bids had been received from seven manufacturers, six of these bids being for the preferred horizontal water-tube boiler of cross-drum type and one for a semi-vertical bent-tube boiler. The Babcock & Wilcox bid ($399,416) was the highest except one.

In his veto message to the City Council the Mayor said:

"My reason for my veto is that the contract was not awarded to the lowest responsible bidder as the charter requires. You will recall that the lowest bid was something over $150,000 less than the highest bid, and that the proposal for bids was open to all kinds and classes of bidders with all kinds and classes of boilers. I am advised that if it is the judgment of your honorable body to select a particular kind of boiler or any other particular kind of article, you must specify that particular article or those particular articles if you would not offend the charter provision which requires all bids to be awarded to the lowest responsible bidder with adequate security."

The City Council, on receipt of the Mayor's message, voted unanimously to reconsider its award, and it is understood that new bids will be called for.

Whitney on Wireless Power

His Demonstration of Its Present Stage Is a Feature of Scientists' Cincinnati Meeting

A DEMONSTRATION of wireless transmission of power was made by Dr. Willis R. Whitney, director of the research laboratories of the General Electric Company, before the convention of the American Association for the Advancement of Science, which met in Cincinnati last week, its convention coinciding with that of the American Physical Society.

Dr. Whitney lighted an ordinary 110-volt incandescent lamp while holding it about a foot from a vacuum tube containing 2,000,000 cycles of alternating current. The lecturer also exhibited a loud speaker lacking a horn and showed how it could reproduce the voice at any magnitude. It was a large disk, about three feet in diameter, stationed at one side of the platform and connected by wires and a vacuum tube with the mouthpiece near the speaker. It did away entirely with metallic noise.

Dr. Whitney explained that the General Electric Company was trying to perfect these loud speakers to a point where they could be used in connection with synchronized motion pictures and speeches.

Dr. Whitney also gave a demonstration of the physiological theory that impulses proceed slowly from the eye to the brain instead of with the speed of electricity or light, but that the phenomena of nerve conduction might be electrical, as some physiologists maintain. He showed the principles on which X-ray intensity is measured by an experiment which began with three balloons, which he charged electrically by rubbing them on his head. They stood out about three feet apart until he shot X-rays on them from a small vacuum tube, when they came together quickly.

Gorgas Plant to Be Enlarged by Alabama Company

The Alabama Power Company has petitioned the Alabama Public Service Commission for authority to add an additional generating unit at the Gorgas steam plant on the Warrior River, which was sold to it by the United States government last September. This addition will be a 20,000-kw. steam turbo-generator with the necessary boilers and auxiliaries. It will cost about $700,000 and is expected to be ready by August, 1924. Its installation, it is said, will mark the completion of the Gorgas plant, which was originally designed for three units. With the new unit its total rating will be 94,000 hp.

Suit has been filed in the Circuit Court of Walker County at Jasper, Ala., by H. E. McCormack, a mine operator of Birmingham, against the Alabama Power Company, asking that the property at Gorgas on which the famous power plant stands be sold for division purposes. The plaintiff claims that a half interest in the site belongs to him.

New Street-Lighting System on Sheridan Road, Chicago

On December 14 Mayor Dever of Chicago closed the circuits which operate the new street-lighting system on Sheridan Road in that city. This system has some noteworthy features.

The 154 posts are spaced about 120 ft. apart from Devon Avenue northward toward the city limits. Hollow-spun concrete posts 14 ft. high are used. Four circuits of parkway cable operating at 2,300 volts on the primary circuit feed the 6.6-amp. lamps. This cable is rated at 5,000 volts and the conductors are No. 8 Brown & Sharpe copper wire. The reflectors used are the Westinghouse octagonal-top type with "Bi-Lux" refractors. The light from each post is rated at 6,000 lumens, and the refractors have so diffused the flux distribution as to keep the shadows on the sidewalk down to a minimum. Series transformers built by the Kuhlman Electric Company are installed in the handholes at the base of the pole or in the regular manholes at the street intersections.

Energy for the system is supplied by the Commonwealth Edison Company. The work was done under the direction of the commissioners of the North Shore Park District, and the contractor, A. M. Ryckoff, finished it in sixty days after he began to lay the cable. The engineers for the commissioners were F. H. Avery and F. A. Gurdes.

Arkansas Company's Ouachita Development Progressing

Work on the Remmel Dam on the Ouachita River is progressing rapidly. This dam, which will be 900 ft. long at the apex and 50 ft. high, is the first of a series of three power dams to be constructed by the Arkansas Light & Power Company. Remmel Dam will create a lake 10 miles long and equivalent in area to 3 square miles, and ultimately 24,000 hp. will be developed on this site. The three dams and power stations provided for in the ten-year program of the company will develop 120,000 hp., and the three lakes created will have a total length of 70 miles. Ten miles up the Ouachita the Carpenter Dam will have a height of 100 ft. and a length of 1,340 ft. This will back the water up in the hills for 24 miles to the base of the Blanco Springs Dam, 160 ft. high and 905 ft. long.

The cost of the Remmel Dam will be $1,500,000. The cost of the entire development will be $15,000,000. A 6,600-volt line now brings electricity to Remmel Dam from the Pine Bluff-Picron-Malvern-Arkadelphia transmission system and will convey hydro-electric power to the twenty-five towns on the system immediately upon completion and operation of the Remmel hydro-electric power station next September. The Arkansas Light & Power Company is now operating one hydro-electric and nine steam power stations, with 700 miles of transmission. The company serves forty-eight cities and towns in a territory containing approximately one-fourth of the population of Arkansas.

Briefer News

Another Federal and Interstate Compact Under Way.—At the request of the Governors of Colorado and New Mexico to the President, Secretary Hoover has been appointed by President Coolidge to represent the federal government on a commission for the formulation of a compact to fix the rights of the United States and the States of Colorado and New Mexico in the use, control and disposition of the waters of the Rio Grande.

Boston Edison Establishes Portable Radio Station.—With the wish that radio broadcasting station WTAT may become an institution of general welfare, President C. L. Edgar of the Edison Electric Illuminating Company of Boston inaugurated service Dec. 15 at a new 100-watt installation of the company which is believed to be unique because of its portability. The new station will be devoted to varied programs of popular interest and includes a Western Electric No. 2-A transmitter, operating on a wave length of 246 meters, mounted on a Reo gasoline truck. After the holidays the outfit will be used at the electric shows to be held in the coming weeks in the outlying territory.

Building the Largest Valley Dike in Central Europe. — The valley of the Thaya River in Moravia, Czechoslovakia, is at present being transformed into the largest back-water reservoir of central Europe. It will store 170,000,000 cu.m. of water and form a lake 12 miles long. The hydro-electric plant to be erected will supply 25,000,000 kw.-hr. Hitherto the largest valley storage plant of central Europe was that of the Vorbeltal in Germany, which has a capacity of 50,000,000 cu.m.

Southern Power May Build Plant at Spartanburg, S. C.—The Southern Power Company has obtained options on land near Spartanburg, S. C., where it plans to erect an auxiliary steam plant to serve as a unit in new development which the company has under consideration and engineering plans for which have been prepared. This development, however, is, the company insists, largely contingent on a favorable decision on the application for higher rates now pending before the North Carolina Corporation Commission.

General Engineering & Management Corporation to Hold Convention in January.—Plans are now actively under way for the annual convention of the General Engineering & Management Corporation, which operates and manages the large group of public utility properties controlled by the banking firm of A. E. Fitkin & Company. In addition to the thirty managers of the public utility properties operated by the corporation, bankers, security dealers, prominent engineers and public utility experts from all parts of the country are expected to attend the sessions. The convention will last from Tuesday, Jan. 22, to Saturday, Jan. 26, inclusive.

Five Southern New Jersey Companies to Merge.—Application for approval of the merger of the Atlantic City Electric Company, Cape May County Electric Company, Cape May Light & Power Company, Hammonton Electric Company and West Jersey Electric Company has been made to the Board of Public Utility Commissioners of New Jersey. The new name of the merged corporations will be the Atlantic City Electric Company. The five companies have an announced standing authorized capital of approximately $4,000,000.

Another Mine Electrification. — Following a fire at the colliery of the Enterprise Coal Company at Excelsior, Pa., the company has decided on the electrification of the colliery, and this change will probably be completed by Feb. 1. Everything in the breaker will be operated by electricity. Self-dumping cages are being placed at the top of the breaker, and motors will be installed to drive all pumps and lift the coal from one elevation to another. Several buildings are being constructed for the housing of the necessary transformers. In another building there will be a motor-driven air compressor.

Nebraska Power Company Sees No Help from Missouri River.—In reply to the suggestion that hydro-electric power be obtained from the Missouri River, a bulletin issued by the Nebraska Power Company of Omaha says: "When the river is running bank-full, if we could utilize without loss every drop of water, we could produce less than 1,000 hp. It takes over 50,000 hp. to run the plant at present." The prohibitive cost of the dam is shown by the fact that for every thousand horse-

power developed a wall one foot high would be required. The Missouri River has a fall of about one foot in each mile so a dam 50 ft. high woud back the water up for fifty miles or half way to Sioux City. This would mean that at least 75,000 acres of valuable farm land would be inundated, to say nothing of towns, villages and railroads, the bulletin aserts.

Merger in Up-State New York Sanctioned.—The Public Service Commission of New York has authorized the New York Central Electric Corporation to purchase the Perry Electric Light Company, Warsaw Gas & Electric Company, Hornell Electric Company, Dansville Gas & Electric Company, Yates Electric Light & Power Company and Wayne Power Company. As recorded in the ELECTRICAL WORLD, permission to bring about this merger was asked last July. The companies named operate in that section of the state southwest of Rochester, and one of them, the Yates Electric Light & Power Company, has valuable water-power rights which will be developed by the newly formed corporation.

Gaining Ground at the Patent Office.—A reduction of 12,035 in the number of patent, design and trademark cases up for action at the Patent Office has been effected during the past three months. On Sept. 21 there were 74,256 applications for patents on hand and on Dec. 21 there were 65,010 applications unacted upon, showing a net gain of 9,241. Applications of designs were reduced from 2,113 on the September date to 887 on Dec. 21, showing a decrease of 1,226. Action was also taken on 1,563 trademark applications, reducing the number on hand from 3,341 to 1,778. The Patent Office likewise reports that all applications on patents are being acted upon within nine months at the present time whereas a year ago a delay existed of fifteen months. Applications for designs receive action within ten weeks now, while a year ago it took eight months. Trademark applications are being disposed of in seven weeks. A year ago the Patent Office was so far behind in its work that it took more than five months to get final action on trademark applications.

Wisconsin Commission to Take Time Before Fixing Rates for "Loop" Cities.—Owing to the far-reaching importance of its decision, a period of six months for investigation and study will be taken by the Wisconsin Railroad Commission before it will issue its final order ratifying or disapproving the tentative rate schedules adopted by the Wisconsin-Minnesota Light & Power Company to end the situation that was brought about when the Supreme Court of the state overthrew the former "loop" system of uniform rates. Thirty-five Wisconsin cities and towns are included in the new schedules, which will bring a reduction of about 1 cent a kilowatt-hour as compared with the rates in force since the court's decision. City officials are in accord with the schedules under consideration.

Electrification of Staten Island's Steam Railroad.—The Baltimore & Ohio Railroad, which controls the three steam-railroad lines of the Staten Island Rapid Transit Company, operating in the coterminous Borough of Richmond, New York City, is about to conduct a survey to expedite the electrification of the 100 miles of track comprised, in view of the rapid growth of population expected to follow the approaching connection of the island by tunnel to the Brooklyn subway system. The cost of the work involved in the electrification will be made public in detail after the survey is complete. Borough President Lynch, who wants the city to take over the lines and electrify them itself, believes that the electrification will require $10,000,000 and take about five years to complete.

City of Los Angeles Plans Steam Plant.—The Public Service Commission of the city of Los Angeles has instructed the chief electrical engineer of the Bureau of Power and Light to prepare an estimate of the cost of establishing an emergency steam plant for use in connection with the city's existing hydro-electric plants along the aqueduct supplying water for domestic purposes to the city. Tentative plans call for an expenditure of a million and a half dollars for the plant. Instructions were issued at the same time for a conference to be held with the Southern California Edison Company to take up the subject of modifying its contract with the city by which the city purchases all energy required over and above the output of the city's hydro-electric plants. It is stated that before the Bureau of Power and Light can construct a steam plant the provisions of this contract will have to be modified.

Big Development to Be Carried Out in Lake Superior District of Ontario.—According to an announcement made at Port Arthur, Ontario, by the chairman of the Ontario Hydro-Electric Power Commission, the commission's plant at Cameron Falls, in the upper Lake Superior district, is to be further enlarged and will eventually be one of the largest in Ontario. The announcement said that the Cameron Falls development will exceed 100,000 hp. and that with the diversion of the rivers flowing north the commission will ultimately build up a capacity of 300,000 hp. or more. The Cameron Falls plant as it exists now has two units and is capable of developing 25,000 hp. An additional unit is under construction and will be completed within a year. In considering the future of this plant thought is being given to the possible electric treating of the vast supplies of low-grade iron ores in the district as well as the requirements of additional pulp and paper mills which will, it is expected, be built there. The commission's rate to large users around Fort William and Port Arthur is placed in recent contracts at $18 per horsepower-year.

Associations and Societies

Iowa Engineering Society. — This society will hold its annual meeting at the Montrose Hotel, Cedar Rapids, on Jan. 29-Feb. 1. The electrical section will have its session on Wednesday, Jan. 30, in parallel with the other sections, and there will be general sessions on Thursday and Friday.

Safety Engineers to Meet.—A joint meeting of the Engineering Section of the National Safety Council and the American Society of Safety Engineers will be held on Jan. 22 at the Engineering Societies Building, New York City. Among the subjects discussed will be the causes of accidents in handling material and ways by which they can be eliminated. Safety in electric welding and cutting will be the subject of a paper by D. H. Deyoe, General Electric Company, and "Glare, What It Is, What It Does," will be the topic of Charles Sheard, American Optical Company, who will deal with radiant energy.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in this issue on page 72.]

American Engineering Council (F. A. E. S.)—Washington, Jan. 10-11. L. W. Wallace, 26 Jackson Place, Washington.

Kentucky Association of Public Utilities—Seelbach Hotel, Louisville, Jan. 10-11. E. F. Kelly, Louisville Railway Company.

Wisconsin State Association of Electrical Contractors and Dealers—Pfister Hotel, Milwaukee, Jan. 17-19. H. M. Northrup, 23 Erie Street, Milwaukee.

National Association of Lighting Equipment Dealers — Hotel Sherman, Chicago, Jan. 21-26.

American Society of Safety Engineers—Engineering Societies Building, New York, Jan. 22.

Technical National Section, N. E. L. A.—Birmingham, Jan. 28-Feb. 1.

Western Association of Electrical Inspectors—Hotel Fontenelle, Omaha, Jan. 29-31. W. S. Boyd, 175 West Jackson Blvd., Chicago.

Iowa Engineering Society—Montrose Hotel, Cedar Rapids, Jan. 29-Feb. 1. R. H. Freese, Cedar Rapids.

American Institute of Electrical Engineers—Midwinter convention, Bellevue-Stratford Hotel, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

American Physical Society — New York, Feb. 23.

Commercial National Section, N. E. L. A.—St. Louis, Feb. 27-28.

Wisconsin Utilities Association — Hotel Pfister, Milwaukee, April 17-18. John N. Cadby, 445 Washington Bldg., Madison.

American Electrochemical Society—Hotel Bellevue-Stratford, Philadelphia, April 24-26. C. G. Fink, Columbia University, New York.

Nebraska Section, N. E. L. A.—Omaha, May 8-9. H. M. Davis, Bankers' Life Bldg., Lincoln.

National Electric Light Association—Atlantic City, N. J., May 19-23. M. H. Aylesworth, 29 West 39th St., New York.

Commission Rulings

What Are Reasonable Rates?—"The question of whether given rates are or are not reasonable," said the California Railroad Commission in determining charges for the Coast Valleys Gas & Electric Company, which serves a developing territory and is faced with the problem of improving and reinforcing its existing system as well as making the necessary extensions to supply new consumers, "depends as much upon the character of service supplied as upon the price which the consumer must pay for it. When service supplied by a utility is all that it should be, the conditions under which that service is extended to the community are liberal and the rates charged are found to produce more than a reasonable income, those rates should clearly be reduced. On the other hand, if the service to the community in the broad sense is capable of distinct improvement, it would seem more desirable to reduce any excessive net revenue by increasing the quality of service rather than by decreasing the price paid for it. In the present case, the company appears to be making every effort to give good service that is consistent with its financial ability. We believe, however, that the service is capable of improvement and should be extended to new consumers and to unserved portions of the territory covered under a more liberal policy than that now followed. The schedule of rates embodied in the order accompanying this opinion will, therefore, not result in the extreme reduction which might be justified, but the company will be expected to continue the improvement of its system and to initiate a more liberal policy in the construction of line extensions."

Fixing the Rate of Return.—After completing its valuation of the Coast Counties Gas & Electric Company the California Railroad Commission addressed itself to fixing the proper rate of return, on which it said: "The proper return to be allowed upon this rate base cannot be determined by any mathematical calculation. A reasonable rate of return is one which, when applied to a group of utilities, with due allowance for the special conditions involved in each case, will be sufficient to encourage the investment of requisite additional capital to enable the business as a whole to expand and keep pace with the demands upon it. The financial requirements of such individual concern enter into this consideration only as they affect the whole and as they indicate special circumstances which must be given weight. Ten years ago this commission allowed 8 per cent upon a reasonable estimate of investment as a fair return in certain cases, and subsequent developments have confirmed the reasonableness of such a figure from the standpoint of both the utility and the consumers. Since that time the business of generating and distributing electricity has vastly increased in extent and importance. Weaker companies have been eliminated by consolidation, and destructive competition has almost disappeared. Conservative financing under public control and increased recognition of the importance of utility service to the community have increased the confidence of the investor. All these things tend to make possible a reduction in the rate of return which must be allowed in order that electric utilities may secure the capital necessary to their growth. On the other hand, interest rates and the return on capital invested in other lines of endeavor are higher than formerly, and the necessity for expansion during the period of even higher interest rates than those now prevailing has resulted necessarily in an increase in fixed charges. The particular utility now before us is not an unusually large company and serves no large cities. Its securities do not have the broad market and wide reputation of the larger companies. After due consideration of all factors, the commission believes that in this instance a net return of 8 per cent, after the payment of federal income tax, is reasonable."

Recent Court Decisions

Notice to Parties Affected by Commission Order Increasing Rates Unnecessary.—The Supreme Court of Oklahoma held, in Consumers' Gas Company vs. Corporation Commission and City of Miami vs. Same, that, rate making being a legislative power, notice to parties affected by an order of the commission increasing rates upon application of a public service corporation need not be given, unless specifically required by statute. Where the Corporation Commission found that a public utility was entitled to earn a specified sum, but fixed a rate which would not produce such sum, the order fixing such rate would not, the court said, be permitted to stand, but the court would establish a rate that would yield the income found necessary by the commission. (219 Pac. 126.)*

"Wantonness" Did Not Exist Where Knowledge of Dangerous Condition of Wire Was Not Proved.—On a second trial of Conine vs. Alabama Power Company, the Supreme Court of Alabama reversed a verdict for the plaintiff awarding heavy damages for the death of a man who seized hold of a heavily charged hanging wire belonging to the defendant company. It was testified that the manager of the company's plant, who had asserted that the wire was not dangerous, although both he and the victim had been informed that it was charged, seized the wire and was knocked down, but whether his contact with the wire was previous to or simultaneous with that of the man killed was not clearly established. Holding that contributory negligence was for the jury to decide, the Supreme Court none the less remanded the case because the trial court submitted it to the jury on the count of wantonness as well as negligence and no evidence of wantonness, which involves reckless indifference and made it necessary to show knowledge that the wire was dangerous, was produced. (97 So. 791.)

Company Cannot Discontinue Service on Subscriber's Refusal to Comply with Guaranty of Another's Bill.—In Wallace vs. Detroit City Gas Company the Supreme Court of Michigan held that a company furnishing gas under an agreement whereby its agents were authorized to remove the meter and connections on the subscriber's failure to comply with any of the rules of the company had no right to shut off the supply on the subscriber's refusal to pay sums due the company by another subscriber on different premises, even though the subscriber had guaranteed payment by an agreement made four years after his own. (195 N.W. 675.)

Whether Party to Dispute Stole Electricity or Not Is for Judicial Determination.—In Madergano et al. vs. Wisconsin Gas & Electric Company the plaintiffs sued for a restoration of electric service, denying the company's accusation that they had defrauded it by tampering with the meter and refusal to pay the difference between the amount registered and the amount consumed. The Supreme Court of Wisconsin held that the plaintiffs showed by admissions in their own pleading that they did not come into court with clean hands and declared that a sufficient defense had been set up to prove the trial court wrong in granting judgment to the plaintiffs on the pleadings. On the question of court versus commission jurisdiction in the case the Supreme Court said: "The court very properly provided that pending the determination of this dispute the defendant should continue to furnish service. If upon the trial it shall appear that the plaintiffs have unlawfully converted current to their own use, to the damage of the defendant, the rights and obligations of the parties are to be determined in accordance with the rates and rules of service established. This is a pure judicial question and involves the exercise of judicial power. Nor do commissions have power to render a judgment under such circumstances. If, however, it is contended that the rule is unreasonable, the commission would no doubt have power to determine, not the rights of parties, but whether or not the rule *per se* was reasonable, which, theoretically at least, is a question of fact." (195 N. W. 864.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Thomas D. Bond of the power engineering department, Charles H. Tenney & Company, Boston, has been appointed secretary of the New England Central Station Association of Power Engineers.

Walter V. Batson of the consulting engineering organization of French & Hubbard, Boston, has been elected chairman of the New England Section of the Illuminating Engineering Society.

Dr. L. A. Herdt, head of the department of electrical engineering at McGill University, Montreal, and consulting engineer, has been awarded the Cross of the Legion of Honor by the French government.

H. W. Fisher has been appointed technical director in charge of electrical engineering for the Standard Underground Cable Company, Perth Amboy, N. J. Mr. Fisher will continue as manager of the lead-cable and rubber departments of the company.

G. W. Bissell, dean of the engineering department of the Michigan State College of Agriculture, has been made chairman of the sub-committee formed to make a survey and report to the State Public Utilities Commission regarding the extension of electric service for farming interests throughout Michigan.

L. E. Seekins, assistant power engineer Lowell (Mass.) Electric Light Corporation, has been appointed assistant to the local manager, J. A. Hunnewell. Mr. Seekins is well known in the Stone & Webster New England organization and has been active in the Power Bureau of the New England Division, N. E. L. A., and in the New England Association of Central Station Power Engineers.

F. A. Brown, who has been in charge of the statistical department of the Wisconsin-Minnesota Light & Power Company at Eau Claire for more than a year, has been transferred to the Northern States Power Company's office at Minneapolis, where he will make his headquarters as head of the company's statistical department. His wide experience in this phase of the utility business fits him to assume complete charge of the statistical end of the Northern States Power Company's business in the seven different states in which it now operates.

James F. Pollard, for the past three years vice-president in charge of operations of the Coast Valleys Gas & Electric Company, Salinas, Cal., has been selected to be vice-president and general manager of that company, recently acquired by the Byllesby Engineering & Management Corporation of Chicago. Mr. Pollard was formerly connected with the engineering department of the Pacific Gas & Electric Company and with the gas and electric rates department of the California Railroad Commission. He is a graduate of the University of California.

Archibald Page, a Scottish Electrical Engineer

Archibald Page, native of Alloa, Scotland, entered the electrical industry when he began his apprenticeship with R. G. Abercrombie's electrical engineering works in that seaport town. Subsequently he became associated with Mavor & Coulson of Glasgow, and in

© Lafayette, Ltd.

ARCHIBALD PAGE

1899 he joined the staff of the Glasgow Corporation Electricity Department. Six years later he was appointed deputy chief engineer, but in 1917 he resigned from municipal service to become assistant general manager of the Clyde Valley Electrical Power Company, of which he was appointed general manager in 1919. When the electricity commission was established by Parliament in 1920 he was appointed one of its members.

Mr. Page was educated at Dollar Academy and received his technical training at Heriot Watt College, Edinburgh, and the Glasgow and West of Scotland Technical College. He is a member of the Institution of Electrical Engineers and a past-chairman of the Scottish Territorial Center of the Institution.

J. E. Jennings, vice-president and chief engineer of the Milliken Brothers Manufacturing Company, New York, has returned to this country after an absence of about fourteen months. Operating from the company's London offices as headquarters, he designed and contracted for an 80,000-volt transmission line, with 2,500 steel towers, for the South African Railway Administration, as well as several large projects for transmission and radio towers for European and American interests.

Guy W. Faller, assistant general manager of the Denver Gas & Electric Light Company, has been elected assistant vice-president of the recently organized Public Service Company of Colorado. This company was formed by a consolidation of the Denver Gas & Electric Light Company and the Western Light & Power Company.

J. F. Nordstrom, engineer in the distribution department of the Ohio Power Company, Canton, Ohio, a property of the American Gas & Electric Company, has joined the research laboratories of the General Electric Company at Pittsfield, Mass. Mr. Nordstrom has been associated with the American Gas & Electric organization in different capacities for about two and one-half years.

Dr. Leo Hendrik Baekeland, honorary professor of chemical engineering in Columbia University, New York, has been elected president of the American Chemical Society for 1924. Though a Belgian by birth, Dr. Baekeland has long been identified with the progress of chemical science in this country and became well known in the electrical industry through his invention of bakelite, an insulating material. At the present time he is president of the Bakelite Corporation and of the General Bakelite Company. Dr. Baekeland is a past-president of the American Institute of Chemical Engineers and of the American Electrochemical Society.

Obituary

Edward Preston Usher, active in electrical invention in New England in the earlier days of the industry, died at Grafton, Mass., Dec. 26. He was born at Lynn, Mass., in 1851 and about thirty years ago became president of the Milford & Hopedale Street Railway. He was the inventor of a storage battery for street-car propulsion which attained considerable success until its displacement by the overhead-trolley system. His patents were later used in general storage-battery manufacture and were sustained in prolonged litigation between the Brush Electric Company and the Hopedale Electric Company.

Walter H. Sawyer, a consulting engineer of distinguished reputation in the field of water-power conservation, died Dec. 21 at Lewiston, Me. Mr. Sawyer at the time of his death was agent and hydraulic engineer for the Union Water Power Company, Lewiston, and of the Androscoggin Reservoir Company, besides being a partner in the firm of Sawyer & Bean, consulting engineers, Lewiston. He was frequently called as an expert in hydro-electric undertakings.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

THE week in trade has been quiet after the culmination of the holiday market, which assumed such great proportions all over the country. Inventory preparations also have had their effect in the natural desire to hold down stocks to the minimum.

Prices during the week have been practically unchanged. Present sales of armored cable are very active. Manufacturers of this commodity feel that an increase in the price of the product is probably due in the near future owing to the higher costs of steel and wire. Conduit manufacturers are speeding up production in anticipation of the demand in the construction field within a few months.

A price reduction of $3 per 1,000 in squeeze-type connectors reported from the Middle West makes the price there $22 per 1,000 delivered. At the same time a drop from $27 to $25 was effective in the East, following a $2 reduction the week before. There has been gossip of strife between Eastern and Western manufacturers, but this low price, which is said to be about cost, is not expected to last long.

Prices on fourteen styles of miniature lamps were increased from 3 cents to 5 cents each, effective Jan. 1, representing an increase of 10 per cent on this size. Copper wires and bare insulated wires are reported stronger and steadier on the Pacific Coast, with conduit sales quiet.

Synchronous-Motor Deliveries Good—Prices Firm

ALTHOUGH synchronous-motor sales have increased, deliveries are good and prices are firm. This is largely due to the fact that manufacturers have kept pace with the growing demand and have increased manufacturing facilities. Nearly all factories report that they are working to capacity and that many orders are now being booked in the Middle West and South as well as on the Pacific Coast. Owing to the fact that the synchronous motors for the Pacific Coast are nearly all high-voltage machines, those orders represent a large portion of the total in dollars.

Orders from the East are comparatively slow at the present time. It is believed that this is due to the fact that the central-station companies are not aggressively seeking new business because their plants are heavily loaded. However, it is expected that after increases in capacity now in process have been completed the Eastern demand will brighten. This is not looked for, however, until well into 1924.

One manufacturer reports that at the present time he can make deliveries of certain synchronous motors in from one to two weeks, notably those rated at 100 hp. and 164 r.p.m., 185 hp. and 225 hp. and 225 r.p.m. and 275 hp. and 150 r.p.m., all at 220 volts, three-phase, 60 cycles. Certain other sizes can be delivered in from four to six weeks. The longest delivery on synchronous motors of standard size and voltages is ten weeks, with thirteen weeks for some of the larger sizes.

A large purchaser of synchronous motors for use with built-in equipment reports that the synchronous-motor deliveries are ahead of the deliveries of equipment. Although there was some talk among manufacturers of a slight increase in price, price lists just issued show no change, and there appears to be no reason why prices should not remain firm.

The Metal Market

ALL the metals sold in small volume during the week. The copper market is very weak, but as in other metals and materials, a revival in demand is expected soon after the first week of the new year.

Sales of lead have been mostly of carload lots, and prices are unchanged. Zinc producers are holding their prices to a firm basis.

NEW YORK METAL MARKET PRICES

	Dec. 27, 1923 Cents per Pound	Jan. 3, 1924 Cents per Pound
Copper, electrolytic	13.00	12¾
Lead, Am.S.& R.price	7.40	7.50
Antimony	9.00	10.00
Nickel, ingot	27.00 to 30.00	26.00 to 30.00
Zinc, spot	6.35	6.27½
Tin, Straits	46.00	47¼
Aluminum, 98 to 99 per cent	27.00	27.00

ELECTRICAL EXPORTS FOR NOVEMBER, 1923, COMPARED WITH CORRESPONDING MONTH A YEAR AGO

	Value November 1922	Value November 1923
Turbines	$245,596	$63,857
Generators:		
Direct-current:		
Under 500-kw.	46,612	71,561
500-kw. and over		51,624
Alternating-current:		
Under 2,000-kva.	6,413	13,504
2,000 kva. and over	381,926	14,248
Accessories and parts for generators	35,077	*216,340
Self-contained lighting outfits	31,293	37,184
Batteries:		
Primary	88,249	120,162
Storage	149,114	181,568
Power transformers	315,079	397,212
Other transformers	32,524	76,507
Rectifiers, condensers, double-current and motor-generators, dynamotors, synchronous and other converters	43,514	67,678
Switchboard panels, except telephone	323,788	38,672
Switches and circuit breakers over 10 amp.	97,553	121,956
Fuses and fuse blocks	29,525	30,927
Meters and measuring instruments:		
Watt-hour and other meas-ing instruments	31,324	43,220
Volt, watt and ampere meters and other record-ing, indicating and testing apparatus	68,019	122,414
Lightning arresters, choke coils, reactors and other protective devices	43,366	72,121
Motors under 1 hp	66,831	104,999
Stationary motors, 1 to 200 hp.	120,181	262,392
Stationary motors over 200 hp.	48,156	81,937
Railway motors	134,948	133,022
Electric locomotives:		
Railway	548,000	*13,251
Mining and industrial	12,109	38,373
Other motors	14,887	40,186
Rheostats, controllers and other starting and control-ling equipment	76,611	171,044
Accessories and parts for motors	85,147	176,901
Electric appliances:		
Electric fans	34,441	59,263
Electric lamps:		
Incandescent carbon-fila-ment	5,942	6,285
Incandescent metal-fila-ment	95,991	77,331
Other electric lamps	24,664	29,537
Flashlights	19,815	39,341
Searchlights and projectors	19,521	55,630
Motor-driven household de-vices	78,756	66,662
Domestic heating and cooking appliances	73,860	79,980
Industrial electric furnaces and ovens	6,894	13,899
Therapeutic apparatus and X-ray machines, galvanic and faradic batteries, etc.	64,917	92,821
Radio and wireless apparatus	223,180	381,826
Telegraph apparatus	34,615	15,248
Telephone apparatus	318,336	
Magneto telephones	†	15,106
Other telephones	†	38,649
Magneto switchboards	†	870
Other telephone switchboards	†	67,499
Railway signals, switches and attachments	129,212	90,696
Bells, buzzers, annunciators and alarms	5,014	7,113
Spark plugs, magnetos and other ignition apparatus	58,388	143,976
Insulating material	65,149	151,159
Metal conduit outlet and switch boxes	18,125	55,265
Sockets, receptacles and light-ing switches	56,138	93,190
Other wiring supplies and fixtures	127,928	190,155
Other electrical apparatus, not elsewhere specified	480,134	832,214
Globes and shades for lighting fixtures	41,065	49,210
Electrical glassware, except for lighting	7,828	12,433
Electrical porcelain	47,346	148,152
Electrical carbons, carbon brushes, electrodes	163,385	236,058
Insulated wire and cable (iron and steel)	44,750	54,108
Other manufactures of alumi-num	52,817	52,833
Copper:		
Bare wire	265,159	136,985
Insulated wire and cables	177,789	255,120
Total	$5,817,001	$6,311,474

* Appear inconsistent and are being checked back against the original declarations. † Not separately stated prior to Jan. 1, 1923.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Western Electric Promotes R. C. Dodd at Kearny

Announcement of the appointment of R. C. Dodd to the position of assistant works manager of the Western Electric Works at Kearny, N. J., effective March 1, has been made. Mr. Dodd is at present chief of the operating branch at the Western Electric Hawthorne Works in Chicago. He started in telephone equipment manufacturing in 1901 as a student with the company's laboratories in New York City.

Vierheller to Occupy New Quarters

The Vierheller Electric Company has leased the first floor of the building at 1111 Pine Street in St. Louis and will use it for a sales and display room for electrical supplies and fixtures. This firm has been established at 917 Pine Street for a number of years, but has outgrown its present quarters.

Vye-Smith Enlarges Sales Activities

The Vye-Smith Company, Inc., electrical supply jobber at 199 Purchase Street, Boston, has been appointed a distributor in New England for the Multiple Electric Products Company, Newark, N. J.; Burgess Battery Company, Madison, Wis.; Trumbull Vanderpoel Electric Manufacturing Company, Bantam, Conn., and exclusive distributor for New England for the Rutenber Electric Company, Marion, Ind. Ray H. Smith, president, said recently that although the organization has been in business but nine months, the volume of trade handled by it has increased every month and that the sales force in the field has been quadrupled, with increased coverage of territory, particularly in northern New England and western Massachusetts. The outlook for 1924, he announced, is most promising.

Maytag Washer Makes Four-Reel Picture

Work of screening the manufacturing processes in the plant of the Maytag Washing Machine Company, Newton, Iowa, has just been completed by the Rothacker Film Manufacturing Company of Chicago. The picture will be shown to salesmen in wholesale houses, department stores, electrical shops, small retail stores and so forth to familiarize them with the quality of raw material and workmanship and the mechanical perfection that go into the manufacture of the Maytag product. It is to be circulated throughout the country from one distributor to another and will also be used for pioneering work in sections where the electric clothes washer has not yet been introduced.

Wireless Resistor Company Now Producing Heating Element

The Wireless Resistor Company of America, Milwaukee, is now engaged in the production of 3,000 "Glowbar" elements per day, following the acquisition of the Swiss patent rights on this resistor. This organization was capitalized for $100,000 in the State of Wisconsin in 1922. After experimenting with this new resistor, which has a temperature range of 500 deg. to 2,400 deg. F., this company spent $23,000 in providing a laboratory and mixing rooms. This product consists of silicon carbide compound somewhat resembling carborundum and can be formed into bars 4 in. to 52 in. in length with a diameter varying from ⅜ in. to 1 in. The compound has a low thermal coefficient of expansion so that it can be mounted in whatever shape desired. It can be employed in any of the present methods of employing electricity for heat. Arnold Pfau is the president, while W. E. Duersten is general manager of the company.

The Electric Development & Machine Company, 221 North Twenty-third Street, Philadelphia, has arranged a fund of $75,000 for the erection of its proposed plant at Shelmire and Edmund Streets.

Alfred E. Tregenza has resigned from the position he has held for the past eleven years as general sales manager of the Economy Fuse & Manufacturing Company, Chicago. He will soon make known his plans for the future.

The Driver-Harris Company, Harrison, N. J., manufacturer of alloys for electrical uses and owner of the Henderson patents for heat-resisting articles, has brought suit in the United States Court for the Southern District of New York upon Patent 1,270,519, granted to it as assignee, against Hardite Metals, Inc., for making and selling carburizing boxes, which, it is alleged, constitute an infringement of the letters patent.

The Fairbanks Storage Battery Company, Bridgeport, Conn., has changed its name to the Conroy Storage Battery Company.

The Otis Elevator Company, Twenty-sixth Street and Eleventh Avenue, New York City, on Dec. 20 declared a quarterly dividend of $1.50 a share on its common stock, which will be paid Jan. 15, 1924, to stockholders of record at the close of business on Dec. 31, 1923.

New Equipment Available

Short Descriptions of New Apparatus and Accessory Equipment of Interest to the Electrical Industry and Available from Manufacturers and Announcements of New Lines

Automatic Coil-Winding Machine

An automatic coil-winding machine has been patented and placed on the English market by the Automatic Coil Winding & Electrical Equipment Company, Ltd., of London, England. The machine winds coils from ¼ in. to 5 in. in length and round, flat, rectangular or irregular in shape at any desired speed up to 6,000 r.p.m. It accurately registers the length of wire used and automatically stops when the length corresponding to the desired resistance is reached. It will also stop should the wire break or the reel give out. For coils with double windings an extra arm is provided to carry the second wire.

Adjustable Cable Reel Jack

The A. L. Swett Iron Works, Medina, N. Y., have developed and placed on the market an adjustable cable-reel jack with a plain or ratchet head. It is claimed that these racks can swing a 7,000-lb. reel and still be made light enough to be portable. Two sizes are made with bases 26 in. x 12 in. and 40 in. x 16 in., weighing 54 and 65 lb.

Magneto Tachometer

The Weston Electrical Instrument Company, 43 Weston Avenue, Newark, N. J., has improved its magneto tachometer. It consists of a direct-current generator with permanent magnet field. The armature is supported on ball bearings and when operating at 2,000 r.p.m. requires from 0.5 watt to 1 watt. Over-all dimensions are 8¼ in. long x 5½ in. wide x 5 in. high and it weighs about 6¾ lb.

Floodlighting Unit.—The National X-Ray Reflector Company, 232 West Jackson Boulevard, Chicago, has brought out a new portable floodlight for use in large display work, such as automobile showrooms, etc.

Convenience Outlet.—A new side-wired convenience outlet has been brought out by Harvey Hubbell, Inc., Bridgeport, Conn.

Two-Way Plug.—The Connecticut Electric Manufacturing Company, Bridgeport, Conn., has developed a two-way plug, "Extra-Lite," made of bakelite.

New Trade Literature

STOKER.—The Combustion Engineering Corporation, Broad Street, New York City, is distributing a four-page leaflet covering its new "Frederick" multiple-retort stoker.

EQUIPMENT FOR USING PULVERIZED COAL.—The Fuller-Lehigh Company, Fullerton, Pa., is distributing bulletin No. 900, entitled "Pulverized Coal for Boilers," in which it describes the "Fuller-Lehigh" equipment for preparing, conveying, feeding and burning pulverized coal. It has also issued a pamphlet covering the "Fuller-Lehigh" equipment for producing pulverized material. The December issue of the *Fuller News* contains an article describing the "Fuller-Kinyon" system for conveying pulverized materials.

CRANES.—"One Man or Several?" is the title of a folder issued by the Whiting Corporation, Harvey, Ill., covering the "Whiting" bucket-handling cranes. The company is also distributing a booklet describing various types of the "Whiting" electric power-house cranes.

PUMPS.—The De Laval Steam Turbine Company, Trenton, N. J., has issued catalog B, covering the "De Laval" single-stage and multistage centrifugal pumps. The company is also distributing a pamphlet entitled "Efficiency Tests of De Laval Motor-Driven Pump," which gives the results of efficiency tests upon several large units installed in municipal waterworks plants.

FLEXIBLE COUPLINGS.—Smith & Serrell, Central Avenue at Halsey Street, Newark, N. J., are distributing bulletin No. 37, covering the "Francke" flexible couplings for direct-connected machines, manufactured by the John Waldron Company, New Brunswick, N. J.

ELECTRIC CAR PULLER.—The Silent Hoist Company, 302 McDougal Street, Brooklyn, N. Y., has issued bulletin No. 22, describing the "Silent Hoist" electric car puller.

ELECTRIC EQUIPMENT FOR SHIPS.—"Westinghouse Marine Log" is the title of circular No. 1,692 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., in which it describes and illustrates various types of vessels equipped with electrically driven machinery, including merchant vessels, battleships, ferryboats, dredges, etc.

FUEL-OIL-BURNING EQUIPMENT.—The Engineer Company, 17 Battery Place, New York City, has issued a booklet entitled "Oil Burning Under Steam Boilers," in which it describes and illustrates its various systems of fuel-oil-burning equipment, including a new system known as the "SAR."

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Malmo, Sweden (No. 8,739), for electrical supplies, wires and cables and for transformer sheets.

An agency is desired in Zurich, Switzerland (No. 8,715), for radio apparatus for outfits of 300 to 500 miles reach; also for household novelties and new technical inventions (No. 8,734).

Purchase is desired in Benoni, South Africa (No. 8,717), for ventilators and leadlight manufacturing machinery.

An agency is desired in Bilboa, Spain (No. 8,738), for copper bars, electrolytic, and electrolytic copper ingots.

An exclusive agency is desired in Amsterdam, Netherlands (No. 8,740), for heating and lighting apparatus for gas, electricity and petroleum.

PROPOSED RAILWAY ELECTRIFICATION IN NORWAY.—Recommendations providing for the electrification of a stretch of railroad between Drammen and Kongsberg, according to *Commerce Reports*, have been passed by the Norwegian Railroad Committee. The cost of the work is estimated at 3,500,000 crowns.

NEW TELEPHONE SYSTEM PROPOSED FOR TAMPICO, MEXICO.—The Tampico-Mexico Telephone Company, recently organized, according to *Commerce Reports*, plans to begin work at once on the installation of a local telephone exchange in Tampico with long-distance connections to Victoria and Tamaulipas. Later it expects to extend the lines to Monterey and the Texas border. Many of the large petroleum companies maintain private telephone lines, which the new company expects to absorb into its new public system.

TWO SCHEMES PROPOSED FOR FURNISHING ELECTRICITY IN THE AGRICULTURAL DISTRICTS IN FRANCE.—Application has been made for official sanction for two schemes to supply electricity in the agricultural districts of the department of the Somme. One, proposed by the Société d'Intérêt Collectif Agricole de la Région de Ponthieu, consisting of thirty-two townships, and the other promoted by the Société d'Intérêt Collectif Agricole de Région de Péronne, comprising forty-two townships.

New Incorporations

THE GRAYSVILLE HOME ELECTRIC LIGHT & POWER COMPANY, Chattanooga, Tenn., has been incorporated with a capital stock of $10,000. R. Guy Fry is secretary.

THE POWER PRODUCTION COMPANY, Houston, Tex., has been chartered with a capital stock of $30,000. The incorporators are C. S. Powers, John H. Roach and others.

THE SALT POINT ELECTRIC LIGHT & POWER CORPORATION, Reading, N. Y., has been incorporated with a capital stock of $900 by Eugene Rondiraro, L. Perazinni and N. Frank, all of Reading.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

DAMARISCOTTA, ME.—The property of the Lincoln County Power Company has been purchased by the Central Maine Power Company, Augusta.

FAIRFIELD, ME.—The Central Maine Power Company has preliminary plans for extensions and improvements to its local power plant.

BOSTON, MASS.—The installation of forty new arc lamps on Blue Hill Avenue in connection with other improvements is under consideration by the Street Commission.

BOSTON, MASS.—The Ford Motor Company, Highland Park, Mich., plans to build a power house at its proposed assembling plant in the Charlestown section, to cost about $500,000.

HAVERHILL, MASS. — The Haverhill Electric Company has commenced work on extensions to its local power house, to cost about $35,000. Charles H. Tenney & Company, 200 Devonshire Street, Boston, are engineers.

WORCESTER, MASS.—Plans are being considered for the construction of a large electric plant by the American Steel & Wire Company to furnish electricity to its three plants. The proposed plant will be located at the south works and will cost about $5,000,000. Work has already started on equipping the mills for electrical operation. Energy will be obtained from the New England Power Company.

WARWICK, R. I.—The installation of a new street-lighting system in Warwick is under consideration by the Town Council.

Middle Atlantic States

BUFFALO, N. Y.—The Niagara Falls Power Company contemplates the construction of a 450,000-kw. substation near the city limits.

FISHERS, N. Y.—Surveys are being made by the Rochester Gas & Electric Company for extending its service to the villages of Fishers and Mendon.

GLOVERSVILLE, N. Y.—The Fulton County Gas & Electric Company has been granted permission to extend its transmission lines to the towns of Esperance and Schoharie to furnish electrical service in both places.

INDUSTRY, N. Y.—The State Building Improvement Commission has given its approval of the new contract submitted by the Niagara, Lockport & Ontario Power Company and the Livingston-Niagara Power Company for the erection of a power transmission line through the property of the State Agricultural and Industrial School at Industry.

LE ROY, N. Y.—The Bergen (N. Y.) Electric Company has applied for a franchise to supply electricity in the northern section of the municipality.

MANSFIELD, N. Y.—The Olean (N. Y.) Electric Light & Power Company has been granted permission to construct and operate an electric lighting system here.

PHILADELPHIA, N. Y.—The Antwerp (N. Y.) Light & Power Company has been granted permission to construct and operate an electric plant and furnish electrical service here.

UTICA, N. Y.—The Utica Gas & Electric Company has engaged the T. E. Murray Company, Inc., 55 Duane Street, New York City, to prepare plans for a large steam-driven plant to be erected at Harbor Point in Utica, to have an ultimate capacity of 250,000 hp. Plans for the initial unit provide for a power house equipped with two 33,000-hp. units.

WATERTOWN, N. Y. — The Northern New York Utilities, Inc., has issued $1,183,000 in bonds part of the proceeds to be used in connection with a 10,000 hp. hydro-electric plant and a 6,7000 hp. steam-operated station, on which work is under way.

ASBURY PARK, N. J.—The Eastern New Jersey Power Company, recently organized, has applied to the Public Utility Commission for permission to take the properties of the Atlantic Coast Electric Light Company and the New Jersey Water & Light Company and four traction companies. Extensions will be made in the systems. Daniel B. Smith, 763 Broad Street, Newark, is the representative of the new company.

ELIZABETH, N. J.—An increase of $5,300 is allowed in the budget for street lighting for 1924. The proposed extensions include the installation of seventy lamps of 400 cp. on Elizabeth Avenue.

HOBOKEN, N. J.—The Hudson Boulevard Commission is considering plans for improving the lighting system on the Hudson Boulevard from Manhattan Avenue to the Paterson Plank Road.

NEW VILLAGE, N. J.—The installation of electric street lighting in New Village, the system to consist of fifty-six lamps, is under consideration. It is proposed to erect a transmission line from Stewartsville.

NUTLEY, N. J.—Plans are under way for extending the electric lighting system on Franklin Street about 1 mile.

TRENTON, N. J.—The Public Service Electric Company has applied for permission to purchase the system of the Eureka Power Company, operating at Prospect Heights, N. J., Yardley, Pa., and vicinity. Extensions will be made in the transmission system.

ALTOONA, PA.—The Penn Central Light & Power Company is planning to organize five subsidiary companies to erect transmission lines in different sections.

EASTON, PA.—Steps have been taken by the South Side Civic Association for a standard lighting system the entire length of Berwick Street.

HAZLETON, PA.—The City Council is considering extending the ornamental lighting system on North Wyoming Street from Oak to Holly Street.

HUMMELSTOWN, PA.—The Union Electric Power Company has asked approval of the purchase of the property of the Hummelstown Water & Power Company. If taken over, extensions will be made to the plant.

JOHNSTOWN, PA. — The Penn Public Service Company has applied for permission to purchase and consolidate sixty-nine utility companies operating in the northwestern counties in the state. A number of substations will be built and extensions made in transmission lines.

LATROBE, PA.—The West Penn Power Company, Pittsburgh, is planning to erect a substation in Latrobe, to cost about $1,000,000. The proposed station is designed to carry several new superpower lines, one of which is to be extended through Seward for connection there with the plant of the Penn Public Service Company.

MIDDLEBURG, PA. — The Middleburg Light, Heat & Power Company is negotiating for the purchase of five utility companies in operating in different sections of Snyder County, and it will make a number of extensions in its transmission lines.

MIDDLETOWN, PA.—The Metropolitan-Middletown Electric Company has applied

for a franchise to erect a transmission line on a number of streets.

ROYALTON, PA. — The Metropolitan-Royalton Electric Company plans to erect transmission lines on a number of streets.

TAMAQUA, PA. — The Lehigh Coal & Navigation Company is planning to electrify its local No. 9 colliery, replacing steam power in all departments.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company has filed plans for a station to be erected at Fort Avenue and Leadenhall Street, to cost $57,000.

CLARKSBURG, W. VA. — Work has started on the substation of the Monongahela West Penn Public Service Company in Northview to distribute high-tension current in Clarksburg.

TRALEE, W. VA.—The Sullivan & Pocahontas Coal Company, recently formed, plans to install electric power equipment and mining machinery at its different properties during the coming year, to cost about $1,000,000.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 8 for one motor-generator set for the Bellevue naval station. (Schedule 1734.)

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Jan. 22 for miscellaneous rotary converters and spare parts for Eastern and Western yards. (Schedule 1733.)

WASHINGTON, D. C.—Bids will be received by the purchasing agent, Post Office Department, Washington, D. C., until Jan. 9 for 10,000 ft. rubber-covered cable; also, until Jan. 7 for 3,000 ft. electric cable, twin-conductor.

North Central States

LANSING, MICH.—Bonds to the amount of $1,000,000 have been sold for municipal electric light and power plant.

MARQUETTE, MICH. — Bonds to the amount of $275,000 have been voted for extensions to the municipal hydro-electric plant on the Dead River. Orbison & Orbison, 812 College Avenue, Appleton, Wis., are engineers.

MICHIGAN CITY, IND.—Plans for the proposed new local plant for the manufacture of tile products to be built by V. Milcarek, care of Ohlgrim & Boonstra, architects, Michigan City, include a power house. The cost is estimated at about $300,000.

CALDWELL, OHIO.—Improvements are contemplated to the municipal electric plant, to cost about $15,000, for which bonds have been voted.

CAMBRIDGE, OHIO. — Electric power equipment will be installed by the American Sheet & Tinplate Company in connection with additions at its local Guernsey Works, to cost about $350,000.

DEFIANCE, OHIO.—The installation of an ornamental lighting system on Clinton Street is under consideration by the City Council.

BURLINGTON, KY.—Plans are under way to secure electric light and power service in Burlington and along the pike to Florence, the service to be supplied by the Dixie Light & Power Company, Walton. The cost is estimated at about $11,000.

LOUISVILLE, KY.—The Board of Park Commissioners contemplates the erection of seventy-five lamp standards on the Western Parkway, to cost about $25,000. A. A. Kreiger is city engineer.

LOUISVILLE, KY. — W. J. Hughes & Company plan to build a power house in connection with the rebuilding of their lumber plant, recently destroyed by fire, with loss of about $400,000.

LOGANSPORT, IND.—A power development on the Wabash River, 6 miles below Logansport, to cost about $25,000, is under consideration by J. A. Shafer, Odd Fellows' Building.

SEYMOUR, IND.—Electrically operated pumps will be installed in the proposed new sewerage plant and system, to cost about $240,000. C. H. Hurd, Indianapolis, is engineer.

ALMOND, WIS.—The Almond Electric Company is planning to rebuild its electric plant, recently destroyed by fire, causing a loss of about $10,000. The town is at present without electric service.

ELLIS JUNCTION, WIS. — The Northeastern Power Company, Oconto, plans to build a hydro-electric plant on the Peshtigo River, near Ellis Junction.

MADISON, WIS.—The Madison Gas & Electric Company contemplates extensions, including addition to power house, installation of two boilers, each of 1,000 hp. capacity, and one 5,000-kw. turbine.

POTOSI, WIS.—The Interstate Light & Power Company, Platteville, is negotiating with the Village Board for the purchase of the municipal electric light distribution system, for which it already furnishes energy.

WEST ALLIS, WIS.—The City Council has approved the proposed plan to install ornamental street-lighting systems in three distinct sections of the city. Electricity to maintain the lamps will be supplied by the Milwaukee Electric Railway & Light Company.

ALBERT LEA, MINN.—All bids submitted for the installation of an improved street-lighting system have been rejected, and new bids will be asked at an early date. C. J. Dudley is city clerk.

OWATONNA, MINN.—The City Council has engaged Arthur L. Mullergren, Gates Building, Kansas City, Mo., consulting engineer, to prepare plans for a complete municipal electric light plant, electric distribution system and a central-station steam-heating system, for which $350,000 in bonds have been voted. C. J. Survatius is city clerk.

WILLMAR, MINN.—Plans are under consideration for the installation of a municipal electric plant, to cost about $100,000.

ATKINS, IOWA.—The Modern Light & Power Company has applied for a franchise to erect a transmission line in Linn and Benton Counties.

BONAPARTE, IOWA.—The Iowa Electric Company plans to rebuild its transmission line to Farmington.

ASH GROVE, MO. — Negotiations are under way by Frank Kerr for the purchase of the municipal electric plant. A company will be formed to operate the property, and extensions will be made to the system.

EXCELSIOR SPRINGS, MO.—The North Missouri Power Company has acquired the electric distributing system at Osborn. The company plans to erect a transmission line from Plattsburg to Maysville in the near future.

FAIR PLAY, MO.—Application has been made to the City Council by the Sac River Light & Power Company, Humansville, for a franchise to install an electric system here. The company proposes to erect a transmission line from Humansville to Fair Play.

STOUTSVILLE, MO.—The City Council is considering calling a special election to vote on the proposal to establish a municipal lighting system. It is proposed to secure electricity from the municipal electric plant at Monroe City.

TASKEE STATION, MO. — Plans are being considered by I. W. Rodgers and H. E. Springer, Poplar Bluff, for the construction of a local contrate mill and washer, power plant, etc., to cost about $200,000.

TURNEY, MO.—Arrangements are being made by local residents to install an electric lighting system. It is proposed to secure electricity from the proposed transmission line to be erected by the North Missouri Power Company from Plattsburg to Mayville.

Southern States

ASHEVILLE, N. C.—Plans for the proposed textile mill to be erected by the Sayles Finishing Plants, Inc., Saylesville, R. I., to cost about $2,000,000, include a power plant.

WILSON, N. C.—The Municipal Electric Department is planning to extend the service of the municipal plant to the towns of Simms and Lucama.

FORT PIERCE, FLA.—Bids will be received by C. J. Ryan, city manager, until Jan. 9 for an electrically operated distilled-water ice-manufacturing plant, daily capacity 20 tons, for municipal service.

ST. AUGUSTINE, FLA.—Plans are being prepared for extensions to the municipal waterworks system, including the installation of new pumping engines, to cost from $300,000 to $400,000. J. E. Craig, 427 King Street, Jacksonville, is engineer.

CLEVELAND, TENN. — Electric power equipment will be installed by the Hardwick Stove Company in connection with additions to cost about $500,000, including additional buildings and equipment.

BIRMINGHAM, ALA.—Dwight P. Robinson & Company, Inc., have been engaged by the Southern Railway Company to design and construct extensive additions to their shops at Birmingham. The work includes locomotive repair shops, boiler and smith shop, car-repair sheds, mill shop, power plant, etc.

BELZONI, MISS.—Bids will be received by F. M. Pepper, City Clerk, until Jan. 10 for equipment for the municipal water and light plant, including two 200-kw. turbines and generators, two water-tube boilers, two 500-gal.-per-minute motor-driven centrifugal pump, one 500-gal. motor-driven pump, one 1,000-gal. motor-driven fire pump, two turbine-driven centrifugal pumps for boiler feed, one 1,000-gal. steam-driven fire pump, two 350- 400-hp. Diesel oil engines with generators, eight-panel switchboard and auxiliary equipment, and coal conveying machinery.

MERIDIAN, MISS.—Electrically operated pumping machinery will be installed in connection with proposed improvements to the waterworks system, to cost about $80,000.

NEW IBERIA, LA. — The Loreauville Sugar Company plans to construct a power house in connection with the rebuilding of its local refining plant, recently destroyed by fire. The cost is estimated at about $300,000.

NEW ORLEANS, LA.—Steps have been taken by property owners on Travis Street, between Spring and Louisiana Streets, for the installation of an ornamental lighting system.

AMARILLO, TEX.—Plans are under consideration for the construction of a large electric plant in the gas field adjacent to Amarillo. A. S. Stinnett, is reported interested in the project.

DALLAS, TEX.—The installation of an ornamental lighting system on Rawlins, Hall, Lemmon and Vandelia Streets, in the Perry Heights section, is under consideration.

HOUSTON, TEX.—Plans are being prepared by the Eureka Ice Company for an ice plant, to cost about $150,000.

MAYBANK, TEX. — Steps are being taken for the construction of a municipal electric light and power plant, to cost about $65,000.

SAN ANTONIO, TEX.—Plans are being prepared by the San Antonio Public Service Company for improvements to its plant at Villita Street, to cost about $150,000.

SAN ANTONIO, TEX. — The Columbus Development & Power Company, recently incorporated, plans to cut a canal across the river and build a dam 12 ft. high, to develop about 4,000 hp. Dr. W. S. McDaniel is interested in the company.

TEXAS CITY, TEX. — Electric power equipment will be installed by the Knox Process Corporation at its proposed local oil-refining plant, to cost about $500,000. Leonard Steerman is representative in charge.

Pacific and Mountain States

KELLER, WASH.—Application has been made by R. H. Beavins and associates for the construction of a hydro-electric power plant on Meadow Creek.

SEATTLE, WASH.—Electric power equipment will be installed in the proposed plant of the American Can Company, 120 Broadway, New York City, to be erected at Cedar and Clay Streets, to cost $750,000.

WALLA WALLA, WASH. — The Walla Walla Valley Electric Railway Company will make extensions in its power system in connection with an addition to its interurban line to Umapine, about 6 miles.

YAKIMA, WASH.—A site, consisting of 17,000 acres, it is reported, has been acquired by the Washington Irrigation & Development Company for its proposed Priest Rapids hydro-electric plant.

ASTORIA, ORE.—Plans have been authorized for the installation of an ornamental lighting system on Eleventh Street.

EUGENE, ORE.—Plans are being considered to erect a transmission line from the municipal power plant to Irving, about 6 miles, to furnish electrical service there.

BURLINGAME, CAL.—Plans are being prepared for the installation of an ornamental lighting system on Park Road.

CHULA VISTA, CAL. — The San Diego Cotton Seed Oil Products Company contemplates building a power house in connection with rebuilding its local plant, recently damaged by fire with loss of about $350,000.

COLUSA, CAL. — Plans are being prepared by the Colusa Sand & Rock Company for a gravel and rock-crushing plant. The equipment will include rock crusher, compressors, motors, transformers, etc.

CORONADO, CAL.—The Coronado Water Company plans to extend its water system to outlying districts and will install electrically driven pumps in seven wells. A. Ervast, Union Building, San Diego, is engineer.

LAMANDA PARK, CAL.—At an election to be held soon the proposal to issue $265,000 in bonds for the erection of transmission lines, including a substation to supply electricity to the outlying district will be submitted to the voters.

LOS ANGELES, CAL.—The Southern California Edison Company is planning to rebuild its circuits in the Tropico district, to cost about $8,900.

LOS ANGELES, CAL.—Plans are being arranged for the installation of ornamental lighting systems on Kenmore Avenue and on Atwater Avenue.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Company will place orders for equipment for the first unit of its steam-operated electric generating plant, with capacity of about 100,000 kw., now in course of construction. The plans provide for an ultimate capacity of about 300,000 kw.

MODESTO, CAL.—The voters in the Modesto Irrigation District have approved a bond issue of $500,000 for the completion of the Don Pedro distribution system.

PASADENA, CAL.—The City Council contemplates calling an election to vote on the proposal to issue $250,000 in bonds for extensions to the municipal electric light plant, including new substation, new equipment, transmission lines, pumping plants, etc.

RAMONA, CAL.—Plans are under consideration for the installation of an electric plant in Ramona, to cost about $6,000.

SAN FERNANDO, CAL.—The Council is considering the installation of an ornamental lighting system on various streets, to cost about $25,000. G. H. Schwabland is city engineer.

SAN JACINTO, CAL.—Plans for the proposed local plant of the Riverside Cement & Roofing Company include a power house to cost about $75,000.

SAN RAFAEL, CAL.—Plans are being prepared for the installation of an ornamental lighting system in the business section. Metal standards will be used.

ARIMO, IDAHO.—A franchise has been granted to the Utah Power & Light Company to install and operate an electric light and power system here.

WEISER, IDAHO.—The Southern Idaho Land & Power Company has been granted permission by the Federal Power Commission to build a hydro-electric plant on Crane Creek, Washington County, an initial capacity of 25,000 hp.

WELLTON, ARIZ.—The Gila Valley Power District plans to erect part of its main transmission system and secondary lines, with substations, in connection with its proposed development in this section.

DENVER, COL.—Surveys are being made by the Public Service Company of Colorado for a transmission line to be erected from Fort Collins to the Wellington oil field north of Denver.

TELLURIDE, COL.—Work will soon commence on improvements to the local plant of the Western Colorado Power Company, to cost about $15,000.

BERNALILLO, N. M.—The Albuquerque (N. M.) Gas & Electric Company is planning to extend its light and power service to the Atrisco district at once.

Canada

VANCOUVER, B. C.—The British Columbia Electric Railway Company, it is reported, will soon award contracts for the first unit of its proposed new power plant on Stave Lake and River, to develop 18,000 kw. The cost is estimated at $1,500,000. The present plans provide for an ultimate capacity of 150,000 hp.

CHELSEA, QUE.—Application has been made by the Gatineau Company, Ltd., Ottawa, to the provincial government for permission to construct a hydro-electric plant, including dam and head works, on the Gatineau River at Chelsea.

MONTREAL, QUE.—The Electric Service Corporation, Power Building, contemplates erecting a 4,400-volt transmission line in the municipalities of St. Felix de Valois and St. Jean de Matha, a distance of 7 miles.

CABRI, SASK.—The citizens have voted to install an electric light and power plant, to cost about $14,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Dec. 11, 1923)

1,477,396. STATIONARY INDUCTION APPARATUS; E. D. Treanor, Pittsfield, Mass. App. filed Feb. 3, 1920. Casing and lead-in structure for high-voltage terminals.

1,477,401. AUTOMATIC RECLOSING CIRCUIT-BREAKER SYSTEM; L. S. Walle, Scotia, N. Y. App. filed May 12, 1922. Reclosing of breaker controlled in accordance with load resistance.

1,477,405. AUTOMATIC MOTOR STARTER; L. J. Weber, Scotia, N. Y., and E. C. Gooch, Estes Park, Col. App. filed April 14, 1921. Electromagnetic accelerating switch.

1,477,406. INSULATOR; E. H. Werner, Chicago, Ill. App. filed Dec. 12, 1921. For supporting safety rails in track-side installations of automatic train-signal systems.

1,477,413. RADIO RECEIVING SYSTEM; E. F. W. Alexanderson, Schenectady, N. Y. App. filed June 24, 1921. Means for preventing interference.

1,477,454. ELECTRIC HEATING FURNACE; H. Seibert, Berlin, Germany. App. filed Aug. 16, 1923. Muffle furnace with granular resistance material.

1,477,455. ELECTRICAL SYSTEM; K. A. Simmon, Edgewood Park, Pa. App. filed April 18, 1917. Thermostat for opening circuit of overheated motor.

1,477,456. ELECTRICAL SYSTEM AND APPARATUS; K. A. Simmon, Edgewood Park, Pa. App. filed Nov. 13, 1919. Thermostatic device for indicating temperature of railway motors.

1,477,465. ELECTRICAL SYSTEM; N. W. Storer, Pittsburgh, Pa. App. filed July 5, 1919. Thermostatic device for indicating temperature of railway motors.

1,477,473. SMALL HOT-WATER TANK ELECTRICALLY HEATED; A. Wickey, East Chicago, Ind. App. filed Nov. 16, 1922. Controlled by thermostat.

1,477,474. DYNAMOMETER CONTROL APPARATUS; L. R. Bogardus, Detroit, Mich. App. filed Jan. 16, 1919. For testing gas engines.

1,477,512. ELECTROLYTIC CELL; R. H. McKee, New York, N. Y. App. filed Sept. 4, 1919. Diaphragm type.

(Issued Dec. 18, 1923)

15,733 (reissue). AUTOMATIC BRAKE FOR ELEVATORS; P. Kesten, Huckelshofen, and H. Osborne, Berlin-Wilmersdorf, Germany. App. filed May 6, 1913. To level car with floor.

1,477,528. SIGNALING; H. A. Affel, Brooklyn, N. Y. App. filed March 30, 1920. Transmitting and receiving ringing signals in telephone systems.

1,477,575. TROLLEY SHOE; R. J. Lyle, Kinmount, Ontario, Canada. App. filed Feb. 10, 1923. Sliding shoe.

1,477,580. CONDUCTOR SUPPORT; S. S. Mathes, Mansfield, Ohio. App. filed Oct. 1, 1923. For intersection of trolley wires.

1,477,596. MEANS FOR SUPPORTING AERIAL CABLES; F. L. Rhodes, Short Hills, N. J. App. filed Dec. 5, 1919. Multiple-sag construction with cable hanging from messenger.

1,477,602. ELECTRICAL HEATING UNIT; M. Simon, St. Louis, Mo. App. filed April 25, 1921.

1,477,606. BRUSH RIGGING FOR ELECTRIC MOTORS AND GENERATORS; A. G. Sutcliffe, Chicago, Ill. App. filed Feb. 8, 1923. Brush holder can be reversed.

1,477,608. INDUCTANCE UNIT; A. Taylor, Flushing, N. Y. App. filed June 18, 1921. Variometer for radio circuit.

1,477,609. TELEPHONE-RECEIVER ATTACHMENT; G. K. Thompson, Maplewood, N. J. App. filed April 21, 1923. Soft rubber ring over cord end to rest receiver on shoulder so hands can be free.

1,477,618. WELDED JOINT; M. P. Wetmore, Newark, N. J. App. filed June 22, 1920. Between wire and tube.

1,477,629. ELECTROLYTIC APPARATUS; R. K. Chrisman, Syracuse, N. Y. App. filed May 18, 1921. Oxidation of organic oils.

1,477,645. SIGNAL RECEIVING SYSTEM AND METHOD; R. E. Hall, Chicago, Ill. App. filed Aug. 13, 1919. Reduction of static in radio circuits.

1,477,664. PROCESS OF AND APPARATUS FOR TREATING MATERIALS; H. D. Rankin, Coronado, Cal. App. filed Oct. 21, 1920. Fixation of nitrogen by electric arc.

1,477,668. AMPLIFIER FOR ELECTROMAGNETS; F. Schröter, Berlin, Germany. App. filed March 16, 1921. Method of voltage regulation by glow-discharge tube.

1,477,708. ILLUMINATED COIN TRAY; H. I. Larson, Minneapolis, Minn. App. filed Jan. 13, 1922. When tray is depressed advertising sign forming part of tray is lighted.

1,477,720. TROLLEY HEAD FOR ELECTRIC TRAMCARS; F. Sharp and J. Martin, Barrow-in-Furness, England. App. filed Aug. 4, 1921. Shield prevents wheel from leaving wire when passing frog, etc.

1,477,735. ELECTRIC FUSE IGNITER; M. P. Weinbach, Columbia, Mo. App. filed April 21, 1920. For mining and blasting operations.

1,477,773. DYNAMO-ELECTRIC STATOR; T. Schou and R. I. Behrens, Mansfield, Ohio. App. filed July 14, 1920. For machines having box-type frame.

1,477,774. MOTOR CONTROLLER; E. W. Seeger, Milwaukee, Wis. App. filed Jan. 21, 1921. Overload protection while starting.

1,477,781. REGULATOR FOR ELECTRIC GENERATORS; R. G. Standerwick, Lynn, Mass. App. filed July 29, 1915. Turbo-generator sets for train lighting.

1,477,782. REGULATOR FOR ELECTRIC GENERATORS; C. P. Steinmetz (deceased), Schenectady, N. Y. App. filed July 29, 1915. Turbo-generator set for train lighting.

1,477,787. ARMATURE-BANDING MACHINE; B. W. Todd, Sherman, Cal. App. filed Aug. 18, 1921. Apparatus for maintaining constant tension on banding wire.

1,477,789. MAGNETO IGNITION SYSTEM; C. H. Tower, Cleveland, Ohio. App. filed March 11, 1920. Intensified spark for starting purposes.

1,477,798. HOLDER FOR ELECTRIC LIGHT FIXTURES; P. Altamura, New York, N. Y. App. filed Oct. 20, 1922. Ceiling fixture incloses and rigidly supports socket.

1,477,800. CONNECTING JOINT; A. O. Austin Barberton, Ohio. App. filed April 10, 1919. Method of putting caps on strain insulators.

1,477,802. OIL-WELL HEATER; R. C. Beck, Brooklyn, N. Y. App. filed Feb. 28, 1921. Electric heater with several separate elements.

1,477,807. TROLLEY SWITCH; G. W. Bower, Schenectady, N. Y. App. filed March 25, 1922. Intersection system for trackless trolleys.

1,477,821. ELECTRIC MELTING FURNACE; A. W. Greeg, Chicago, Ill. App. filed July 16, 1921. Metal heated, liquefied and refined by radiant heat.

1,477,822. COIL MOUNTING FOR RADIO APPARATUS; I. Greenwald, New York, N. Y. App. filed Aug. 10, 1922. Three-element coupler.

1,477,826. DETECTOR STAND; R. J. Heitzman, Union Hill, N. J. App. filed June 29, 1922. Crystal type.

1,477,827. INSTRUMENT FOR TRANSMITTING ANGULAR MOVEMENT; L. E. Hildebrand and D. P. Thomson, Lynn, Mass. App. filed Dec. 1, 1921. Self-synchronous instruments for transmission of anguler movement at a distance.

1,477,843. MAGNETO-ELECTRIC GENERATOR; E. B. Nowosielski, Bloomfield, N. J. App. filed March 12, 1920.

1,477,847. MAGNETIZING APPARATUS; A. G. Palmer, Madison, Wis. App. filed July 15, 1922. Apparatus for magnetizing magnets of magneto.

1,477,862. SPEED CONTROLLER; J. M. Barr, Milwaukee, Wis. App. filed Sept. 5, 1922. Speed of induction motor controlled by field windings.

1,477,868. METHOD AND APPARATUS FOR INCREASING ELECTRONIC EMISSION; H. P. Donle, Meriden, Conn. App. filed May 9, 1919. By special electron tube.

1,477,869. ELECTRONIC EMISSION; H. P. Donle, Meriden, Conn. App. filed Feb. 3, 1923. Metallic ions supplied by special glass in electron tube.

1,477,874. TELEPHONE SYSTEM; W. H. Harrison, Hollis, N. Y. App. filed Dec. 30, 1919. Repeater apparatus for toll lines.

1,477,875. ELECTRIC CANDLE LAMP; M. L. Kaplan, Brooklyn, N. Y. App. filed Dec. 29, 1920. Self-contained battery.

1,477,876. ELECTRIC BATTERY LAMP; M. L. Kaplan, Brooklyn, N. Y. App. filed July 27, 1921. Candle fixture with self-contained battery.

1,477,877. ELECTRIC BATTERY LAMP; M. L. Kaplan, Brooklyn, N. Y. App. filed Nov. 9, 1921. Candle light with self-contained battery for table use.

1,477,878. ELECTRIC BATTERY LAMP; M. L. Kaplan, Brooklyn, N. Y. App. filed Feb. 16, 1922. Candle lamp with self-contained battery.

1,477,889. COIL CUT-OUT FOR WIGWAG SIGNALS; M. S. Morse, Los Angeles, Cal App. filed Jan. 25, 1923. For grade crossings.

Directory of Electrical Associations

Printed in the First Issue of Each Volume

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co., Birmingham, Ala.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

AMERICAN ASSOCIATION OF OPERATING ENGINEERS. Secretary H. C. Bristol, Alcoa, Tenn.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Executive secretary, J. W. Welsh, 8 West 40th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Colin G. Fink, Columbia University, New York City.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 143 Liberty St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets bi-monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS. Secretary, F. F. Sharpless, 29 West 39th St., New York.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY. Secretary, M. M. Kelly, 29 West 39th St., New York.

ARKANSAS UTILITIES ASSOCIATION. Secretary, R. I. Brown, Arkansas Central Power Co., Little Rock, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, Frederic Nicholas, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, 80th St. and East End Ave., New York.

ASSOCIATION OF ELECTRAGISTS INTERNATIONAL (formerly National Association of Electrical Contractors and Dealers). Secretary, Laurence W. Davis, 15 West 37th St., New York City, N. Y. Direct membership throughout the United States and Canada.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Room 413. C. & N. W. Terminal Station, Chicago, Ill.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary, Louis Kon, 311 Power Bldg., Montreal.

COLORADO PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, John F. Greenawalt, Mountain States Tel. & Tel. Co., Denver, Col.

ELECTRIC CLUB OF CHICAGO. Hotel Morrison, Chicago, Ill.

ELECTRIC POWER CLUB. Executive secretary, S. N. Clarkson, B. F. Keith Bldg., Cleveland, Ohio.

ELECTRICAL MANUFACTURERS' CLUB. Secretary. Sanford B. Belden, Jeffrey Mfg. Co., Columbus, Ohio.

ELECTRICAL MANUFACTURERS' COUNCIL. Executive secretary, Frederic Nicholas, 30 East 42d St., New York City.

ELECTRICAL SAFETY CONFERENCE. Secretary, Dana Pierce, 207 E. Ohio St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 165 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal, New York City.

FEDERATED AMERICAN ENGINEERING SOCIETIES. Executive secretary, L. W. Wallace, 26 Jackson Place, Washington, D. C.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

GEORGIA ELECTRICAL ASSOCIATION. Secretary-treasurer, W. C. Drake, 75 Marietta St., Atlanta, Ga.

GREAT LAKES GEOGRAPHIC DIVISION, N. E. L. A. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General Secretary, Norman D. Macdonald, 29 West 39th St., New York City. Sections in New York, Philadelphia, Chicago and Boston. Chapters in San Francisco, Cleveland, Columbus, Detroit, Los Angeles, Newark, N. J., Pittsburgh and Toronto.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, W. R. Arbuckle, Bayonne, N. J.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary, M. G. Linn, Des Moines Electric Co., Des Moines, Iowa.

JOINT COMMITTEE FOR BUSINESS DEVELOPMENT. Director, H. A. Lane, 29 West 39th Street, New York City.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, R. T. Smalley, Kansas Electric Power Co., Emporia, Kan.

KENTUCKY ASSOCIATION OF PUBLIC UTILITIES. Secretary E. F. Kelley, Louisville Railway Company, Louisville, Ky.

LIGHTING FIXTURE DEALERS' SOCIETY OF AMERICA. Secretary, J. L. Wolf, Electrical League, Hotel Statler, Cleveland, Ohio.

MARYLAND PUBLIC UTILITIES ASSOCIATION. Secretary, H. T. Connolly, Annapolis & Chesapeake Bay Power Co., Baltimore, Md.

MICHIGAN ELECTRIC LIGHT ASSOCIATION. Secretary, Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

MIDDLE WEST GEOGRAPHIC DIVISION, N. E. L. A. Secretary-treasurer, Horace M. Davis, Bankers' Life Bldg., Lincoln, Neb.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 315 North 12th St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Executive secretary, T. H. Day, 59 Deerfield Ave., Hartford, Conn.

NATIONAL ASSOCIATION OF RAILWAY AND UTILITIES COMMISSIONERS. Secretary, James B. Walker, New York Transit Commission, New York City.

NATIONAL COUNCIL LIGHTING FIXTURE MANUFACTURERS. Secretary, Chas. H. Hofrichter, 233 Gordon Square Bldg., Cleveland, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Managing director, M. H. Aylesworth, 29 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1347 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Chairman of electrical committee, Dana Pierce, 207 E. Ohio St., Chicago, Ill. Secretary of electrical committee, Ralph Sweetland, 18 Oliver St., Boston, Mass.

NATIONAL SAFETY COUNCIL. Managing director and secretary, W. H. Cameron, 168 No. Michigan Ave., Chicago, Ill.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, Horace M. Davis, Bankers' Life Bldg., Lincoln, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, James A. Loring, 99 Bedford St., Boston, Mass.

NEW ENGLAND GEOGRAPHIC DIVISION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, W. J. Kreger, 261 Broadway, New York City.

NEW YORK ELECTRICAL LEAGUE. Secretary, Albert Goldman, 555 East Tremont Ave., New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, T. C. Martin, 29 West 39th St., New York City.

NORTH CENTRAL ELECTRIC ASSOCIATION (Geographic Division N. E. L. A.). Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION (Geographic Division, N. E. L. A.). Secretary, C. H. Gueffroy, 407 Gasco Bldg., Portland, Ore.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OKLAHOMA UTILITIES ASSOCIATION. Manager, E. F. McKay, Oklahoma City.

PACIFIC COAST ELECTRICAL ASSOCIATION (Geographic Division N. E. L. A.). Secretary, Samuel H. Taylor, 527 Rialto Bldg., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary, H. M. Stine, 212 Locust St., Harrisburg, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, R. M. Booker, Newport News & Hampton Railway, Gas & Electric Co., Hampton, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, A. Bliss McCrum, Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, Renville H. McMann, 122 Chambers St., New York City.

ROCKY MOUNTAIN ELECTRICAL CO-OPERATIVE LEAGUE. Chairman, H. M. Ferguson, McIntyre Bldg., Salt Lake City, Utah.

ROCKY MOUNTAIN GEOGRAPHIC DIVISION, N. E. L. A. Treasurer, A. C. Cornell, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. Operating vice-presidents, W. L. Goodwin and F. M. Feiker; secretary-treasurer, J. Smieton, Jr., 522 5th Ave., New York City. Annual meeting second Tuesday in February; directors' meetings second Tuesday in February and November; executive committee meetings every sixty days.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOCIETY OF INDUSTRIAL ENGINEERS. Secretary, G. C. Dent, 608 South Dearborn St., Chicago, Ill.

SOUTHEASTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

SOUTHEASTERN WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

SOUTHERN APPALACHIAN POWER CONFERENCE. Secretary, J. A. Switzer, Knoxville, Tenn.

SOUTHWESTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

SOUTHWESTERN PUBLIC SERVICE ASSOCIATION, Secretary, E. N. Willis, 403-4 Slaughter Bldg., Dallas, Tex.

UTAH ASSOCIATION OF ELECTRAGISTS. Secretary, E. H. Eardley, 54 Exchange Pl., Box 544, Salt Lake City, Utah.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. W. Peterson, Saint Albans, Vt.

WEST VIRGINIA-KENTUCKY ASSOCIATION OF MINE, MECHANICAL AND ELECTRICAL ENGINEERS. Secretary-treasurer, Herbert Smith, 211 Robson-Pritchard Bldg., Huntington, W. Va.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN STATE ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, H. M. Northrup, 23 Erie Street, Milwaukee, Wis.

WISCONSIN UTILITIES ASSOCIATION. Executive secretary, John N. Cadby 445 Washington Bldg., Madison, Wis.

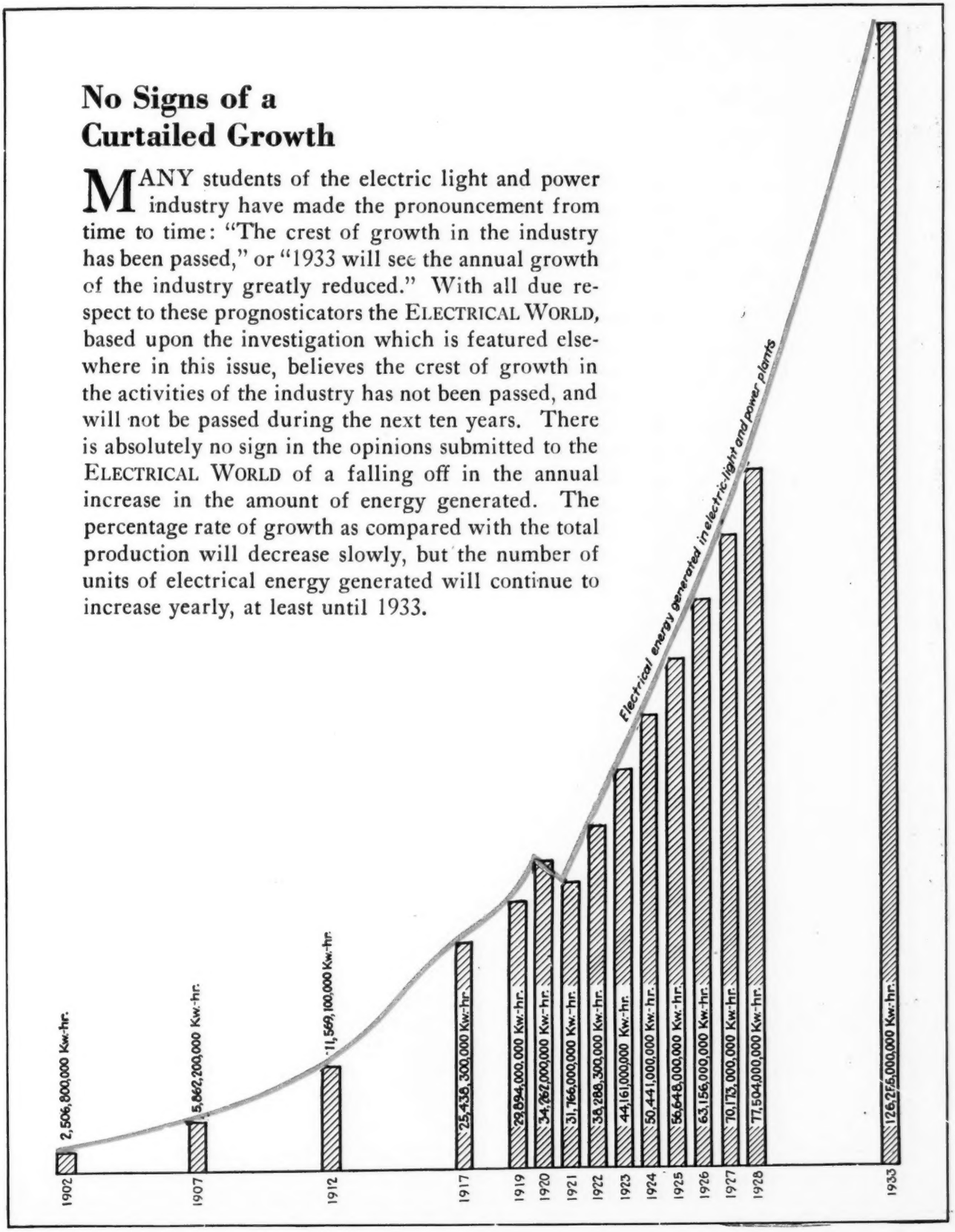
WYOMING UTILITIES ASSOCIATION. Secretary, H. C. Chappell, Natrona Power Co. Casper, Wyo.

Business Facts for Electrical Men

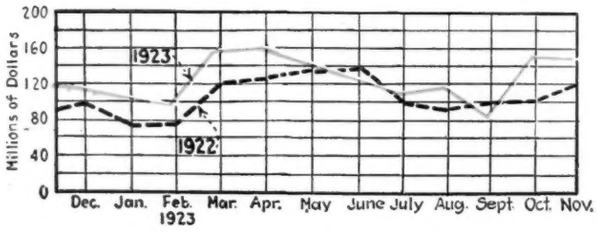
Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

No Signs of a Curtailed Growth

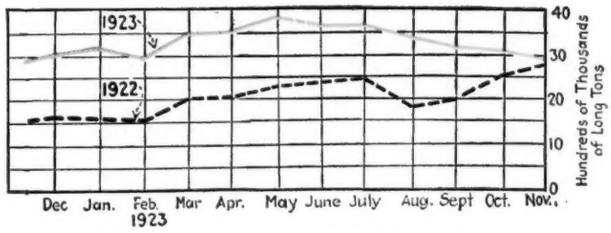
MANY students of the electric light and power industry have made the pronouncement from time to time: "The crest of growth in the industry has been passed," or "1933 will see the annual growth of the industry greatly reduced." With all due respect to these prognosticators the ELECTRICAL WORLD, based upon the investigation which is featured elsewhere in this issue, believes the crest of growth in the activities of the industry has not been passed, and will not be passed during the next ten years. There is absolutely no sign in the opinions submitted to the ELECTRICAL WORLD of a falling off in the annual increase in the amount of energy generated. The percentage rate of growth as compared with the total production will decrease slowly, but the number of units of electrical energy generated will continue to increase yearly, at least until 1933.



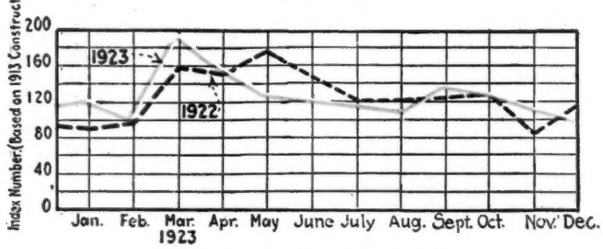
How the Primary Industries Are Trending



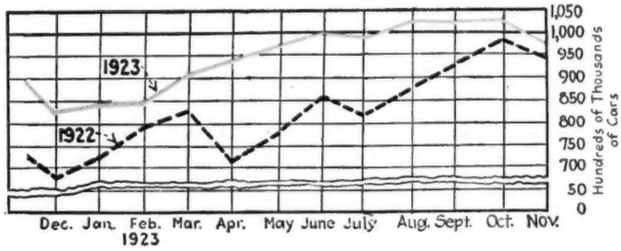
Contracts Awarded for Residential Buildings



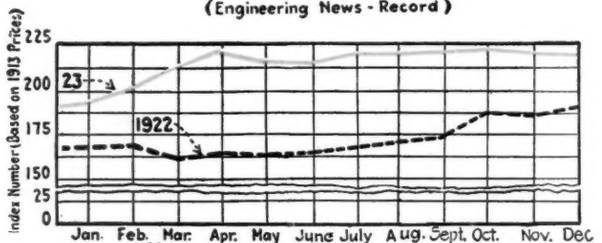
Pig-Iron Production



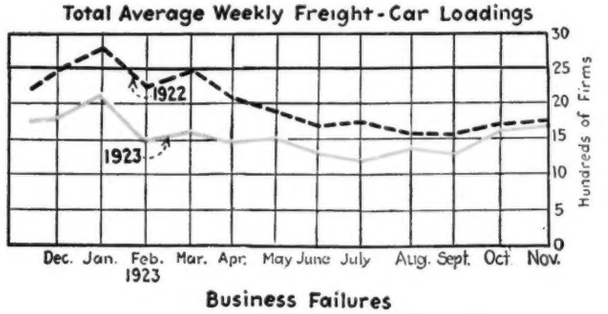
Construction Volume Index
(Engineering News-Record)



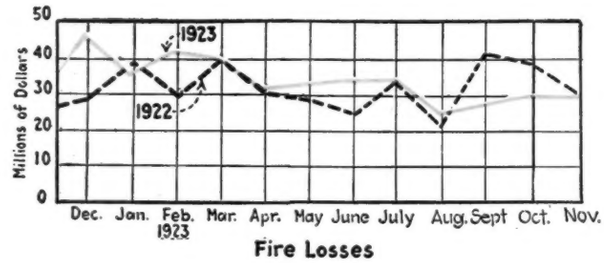
Total Average Weekly Freight-Car Loadings



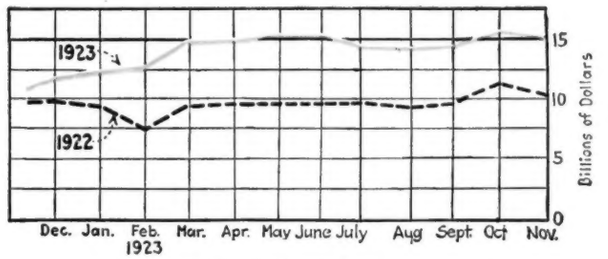
Construction Cost Index
(Engineering News-Record)



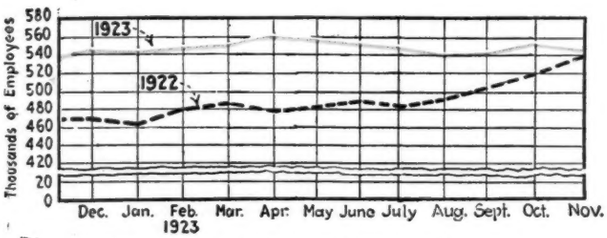
Business Failures



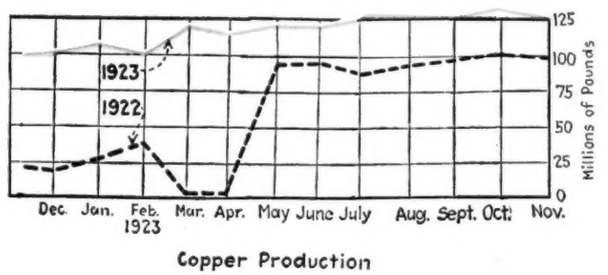
Fire Losses



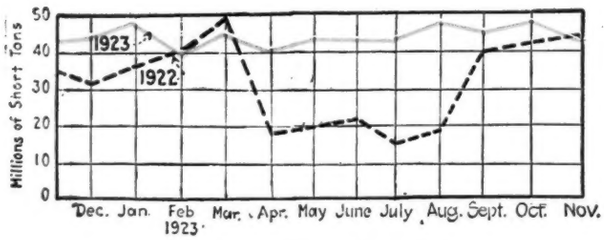
Bank Clearings
Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Bright Prospects for 1924

THE year 1924 opens most auspiciously for American industry at large. Students of economic trends predict that business will improve as the year unfolds, and that manufacturing will be normal, at least during the first half of the year. Business conditions are sound, and no disturbance of these conditions is expected within the next few months.